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THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

One Answer . . . . . *by A. M. Sargent*

Tools and Techniques for Truck-Trailer Production . . . *by Fred M. Burt*

Welding Fixtures for Mass Production . . . . . *by A. E. Rylander*

Fundamentals and Applications of Carbide Milling . . . . *by A. O. Schmidt*

Wire Dimensions for Screw Threads . . . . . *by John Wesley Lee*

We're Going to Houston . . . 15th Annual Meeting, ASTE, Houston, Texas, March 19-20-21-22 . . . *by Doris B. Pratt*

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A.S.T.E. News • Andygrams • Gadgets • Fundamentals of Tool Engineering • Good Reading • Bulletins • Tools of Today • North, East, West, South in Industry • Index to Advertisers

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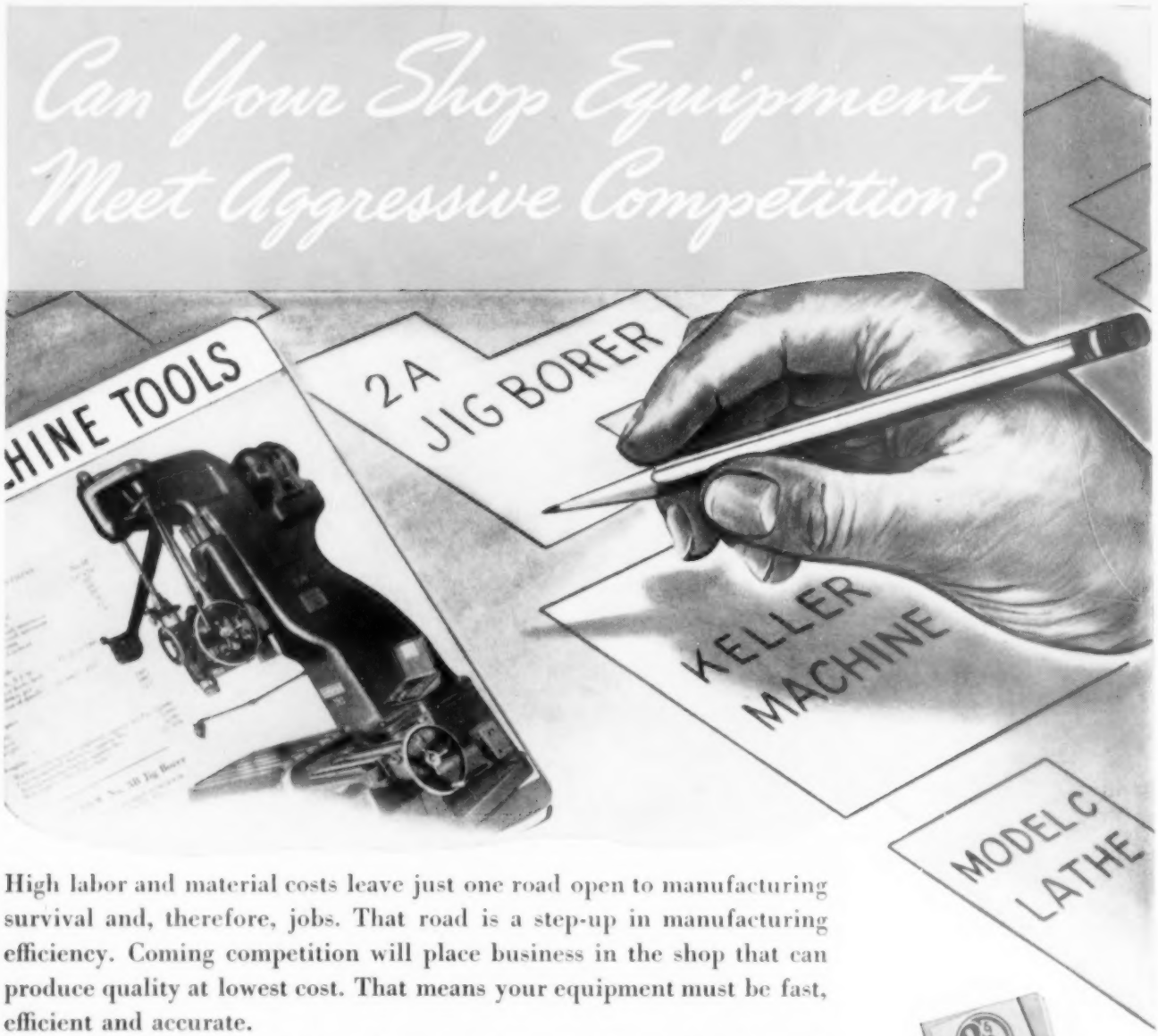

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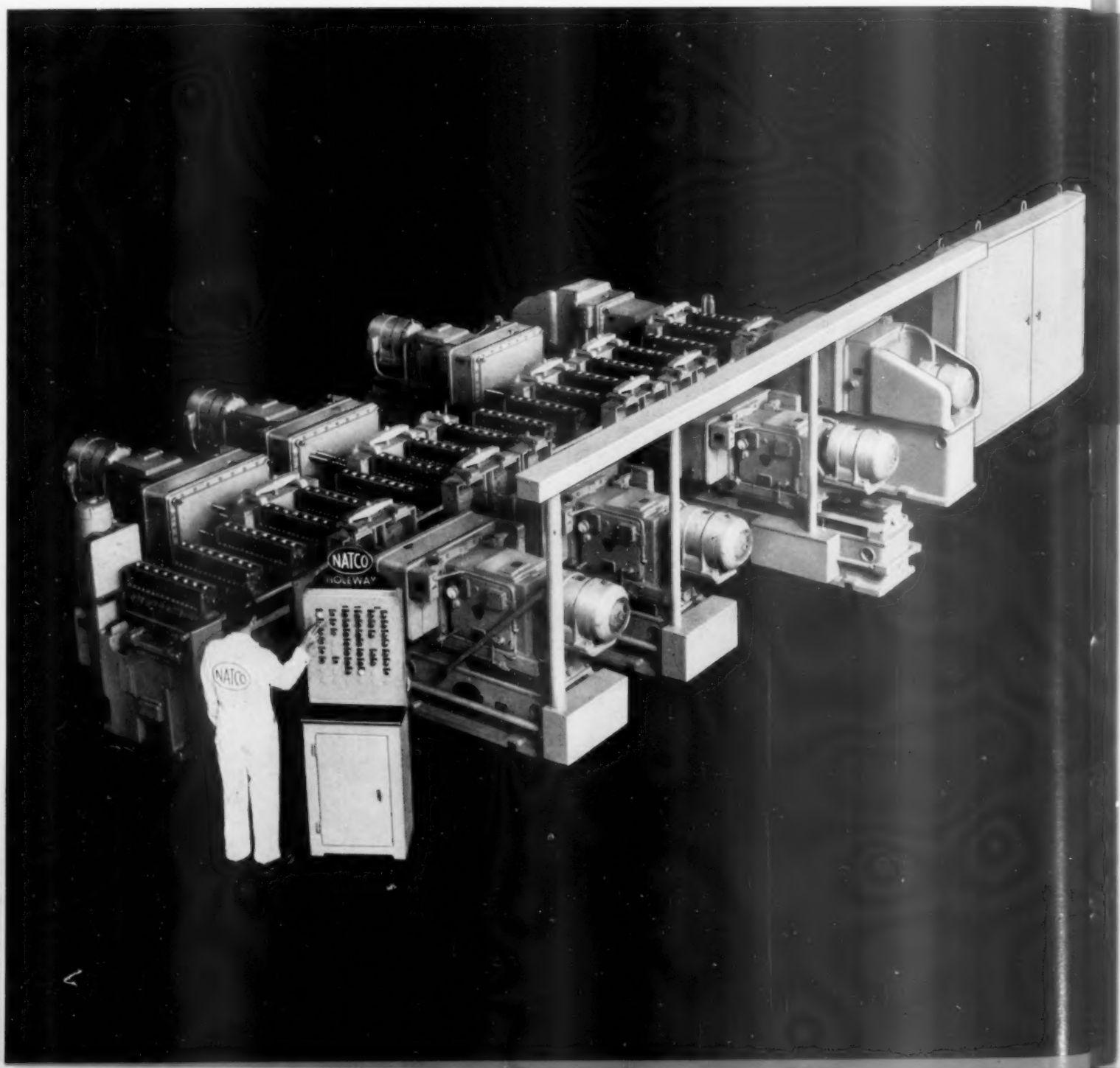

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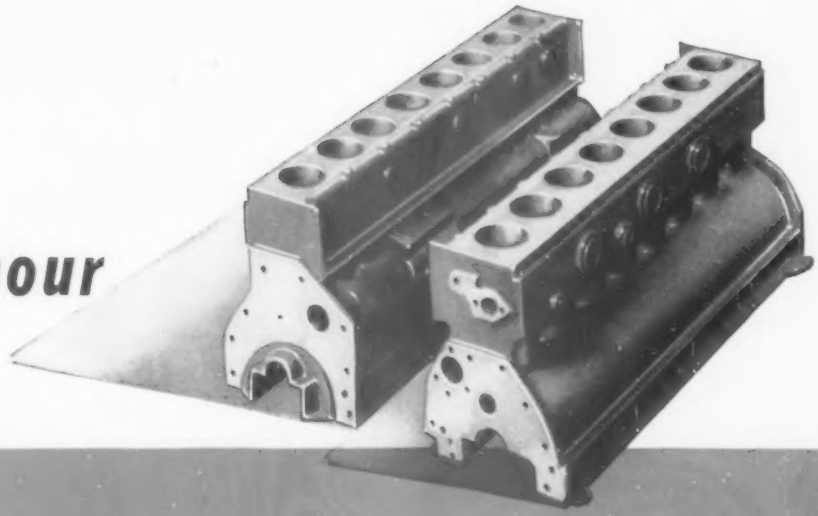

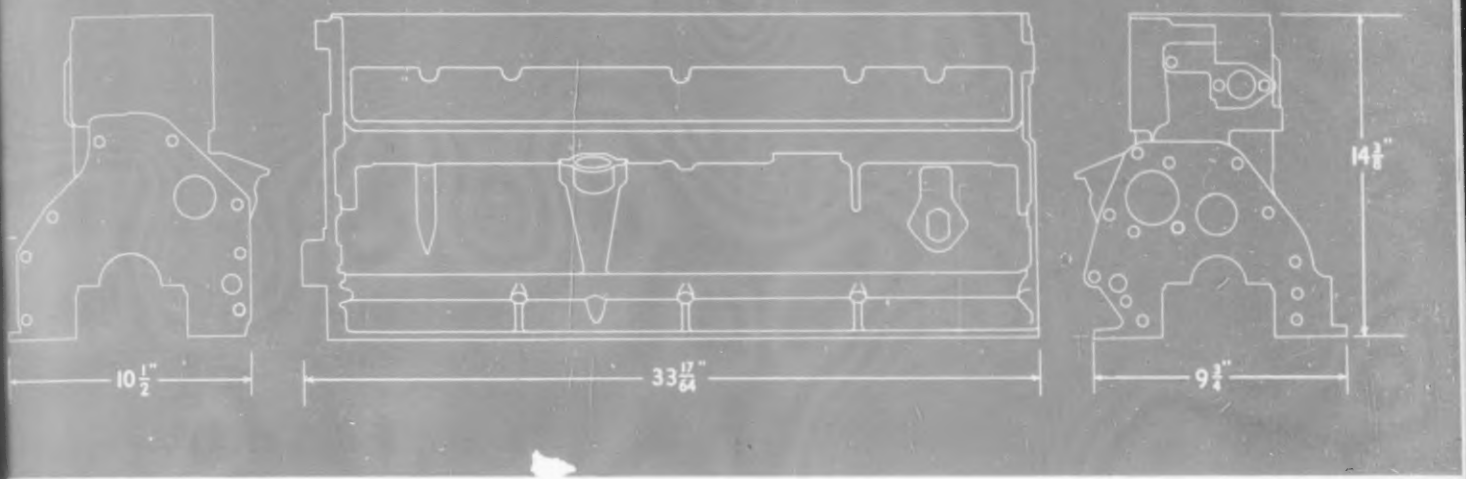

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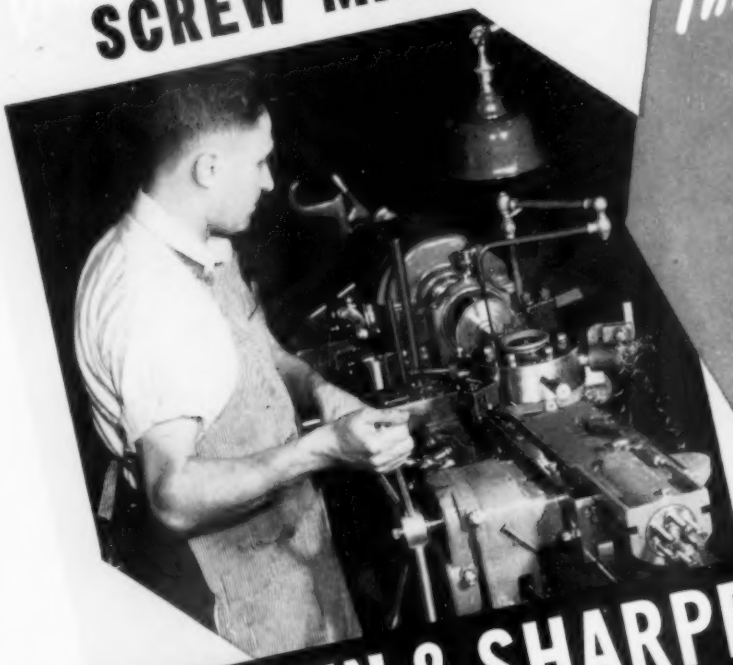

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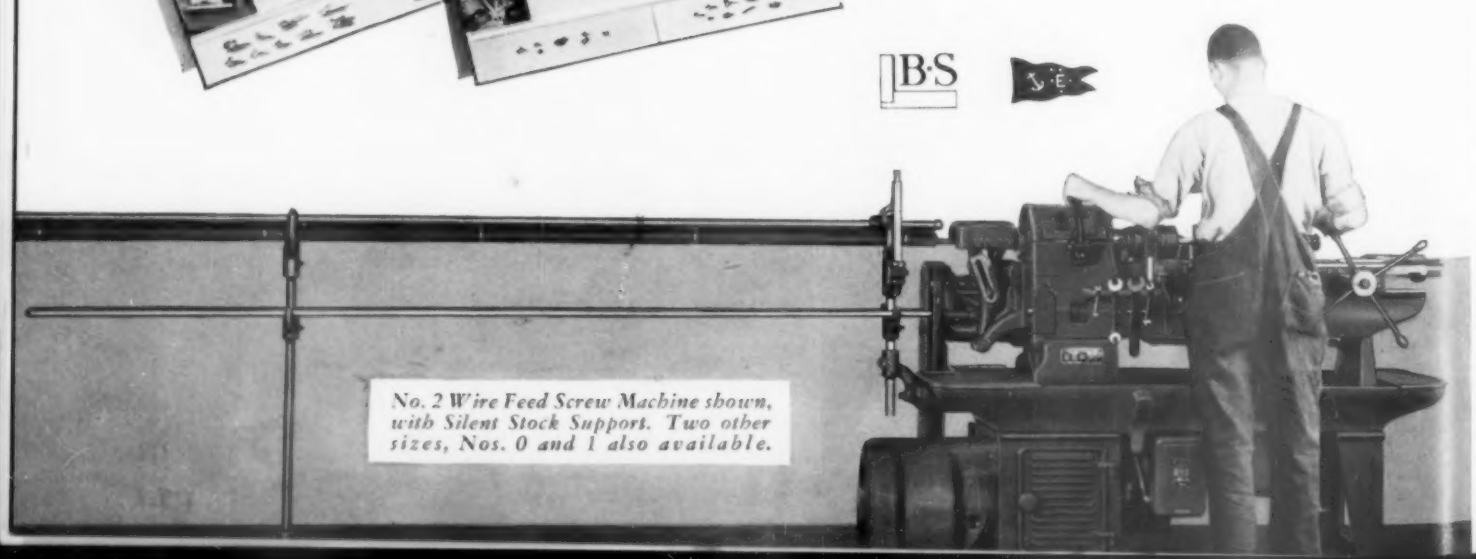

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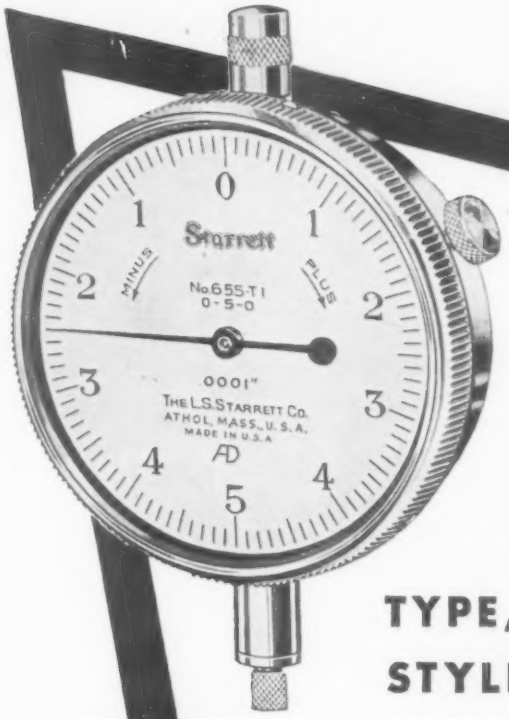

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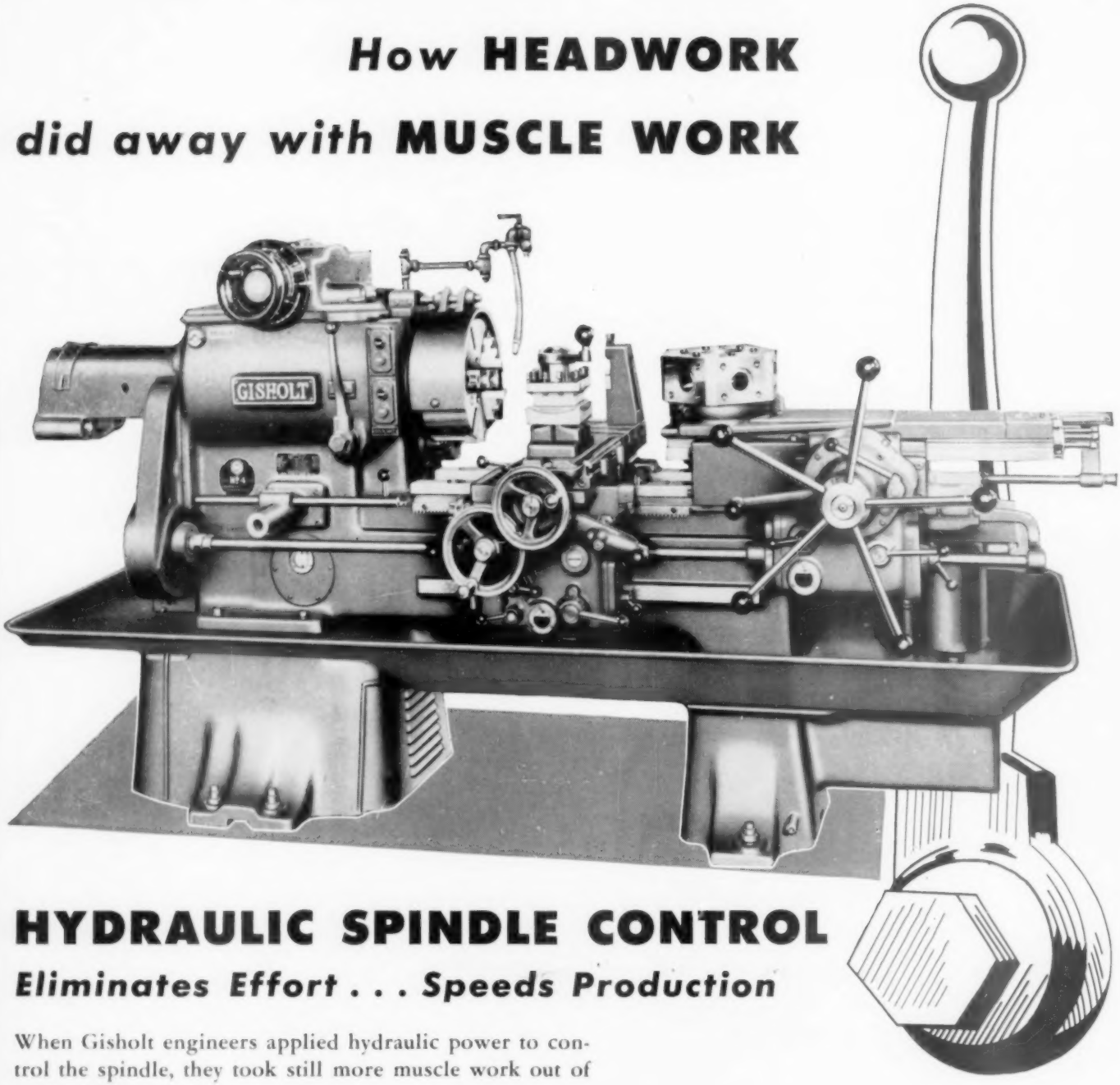

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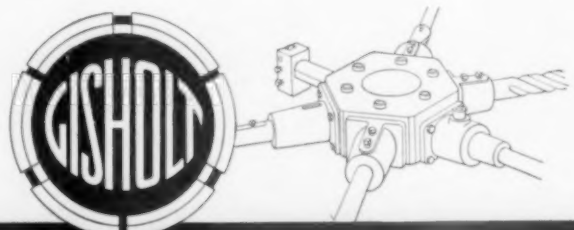

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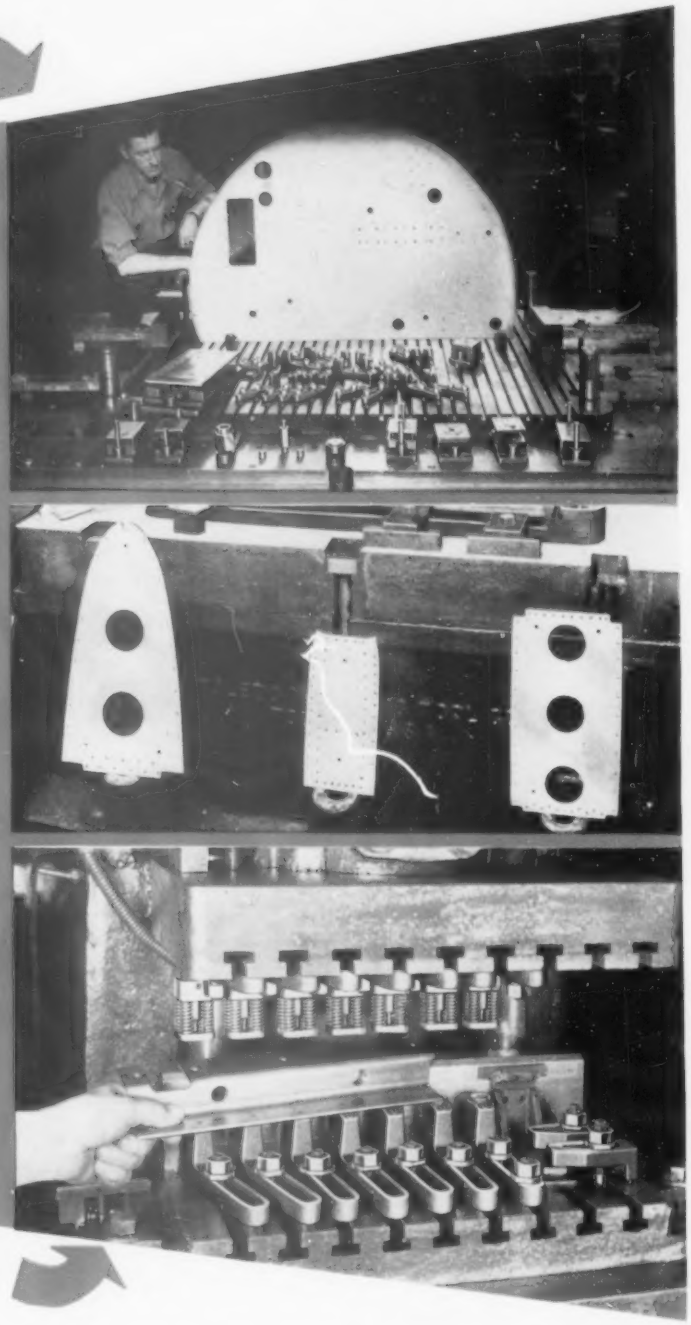

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All types of standard Morse Reamers... and special reamers, too... are available through your Industrial Supply Distributor. A few of these types of Reamers are shown on the facing page. In addition, Morse makes drills, cutters, taps, dies, and special tools which, like Morse Reamers, *will never leave you in the hole.* Ask your Industrial Supply Distributor to get you the Morse recommendation that will give you top reamer performance on *your* particular job.

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No. 1655 Fluted Chucking Reamers: For removing small amounts of metal to enlarge drilled holes and finishing them true and to size.

No. 1733 Expanding Chucking Reamers: When worn slightly below size, expand them slightly and regrind . . . and regrind . . . and regrind. One of these reamers does the work of many solid reamers.

No. 1701 Structural Reamer Spiral Flutes: Designed for use by Structural Workers, Boiler Makers, Bridge and Ship Builders. Made for severe and rough work, for reaming rivet and bolt holes in structural iron and steel work in buildings, bridges and ships as well as boiler plates. They are not ground close to size.

No. 1627 Shell Reamers with Spiral Flutes: Have taper holes, diameter being specified at the large end.

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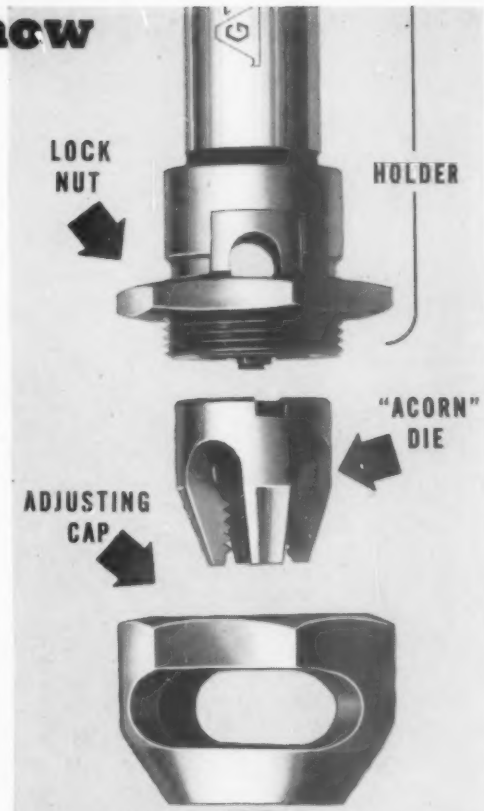
A Few Facts You Should Know About "Acorn" Dies

SIMPLE CONSTRUCTION • EASY TO OPERATE • FACTORY TESTED

To understand the operation of the "Acorn" Die, one should see it in relation to the "Acorn" Die Holder as pictured at the right in sectional view. The feature which makes the "Acorn" Die so convenient and accurate is the manner in which the four prongs or threaded lands are compressed when the holder cap is screwed down onto the holder. As all bearing surfaces on the holder and die are ground to insure correct alignment and accuracy, even pressure is brought to bear on each of the prongs simultaneously so that they all adjust equally and concentrically. This is done quickly and automatically by tightening the cap and turning up the lock nut. No other adjustments are necessary.

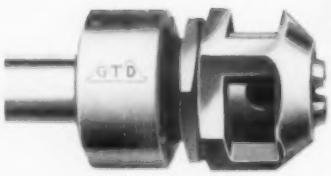
A positive adjustment to size can be obtained by using the threaded plug which comes with every "Acorn" Die. This plug has actually been threaded by the die in which it is shipped and has been carefully checked for accuracy. Thus, if it is used as a setting plug, accuracy of the set up will be assured. *For close to shoulder work, quick change over of jobs, accurate threads, specify "Acorn" Dies to your local Greenfield Distributor.*



HOLDERS ADAPT "Acorn" Dies FOR ANY MACHINE

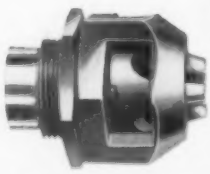
REGULAR

Regular "Acorn" Die Holder with longitudinal float which allows the die to follow its own lead independent of any lag in the machine. This holder may be used on practically all automatic screw machines and any other machines which provide for automatically reversing the die or rod at the instant when the desired length of thread has been cut.



RELEASING

Releasing "Acorn" Die Holder, while suitable for all machines, is especially recommended for hand operated machines. The improved clutch mechanism allows the holder to be released without shock.



ADAPTER

The "Acorn" Die Adapter permits the use of "Acorn" Dies with existing round die holders. It consists of three parts, a Cap to hold and adjust the die, a Lock-Nut to secure the adjustment and a Body. The shank fits round or spring die holders of corresponding size.

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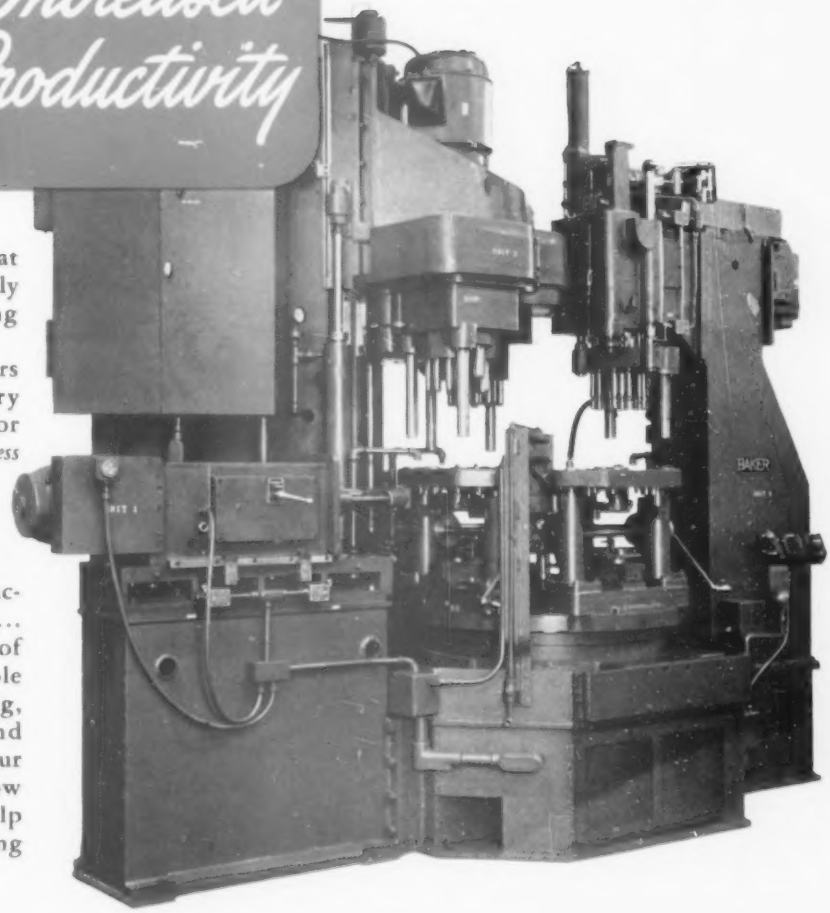
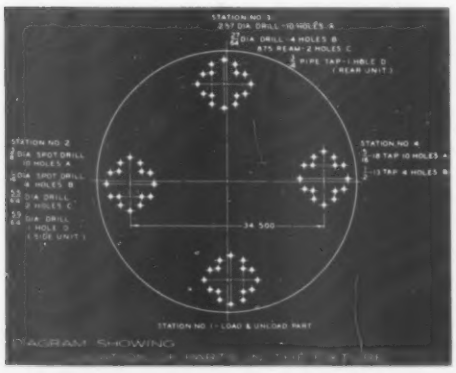
BAKER ... KEY TO Increased Productivity

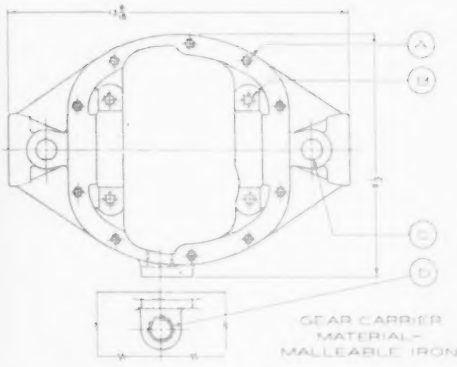


A recent survey of industry shows that *new methods* and *new machines* are highly important factors today in obtaining *increased productivity.*

This is particularly true among users of Baker Machines—because every Baker is designed to make it easier for the operator to produce *more* in *less* time with *less* effort!

By combining operations and reducing work-handling, Baker Machines offer the right set-up for greater production and improved accuracy. Baker units are highly flexible... can be adapted to a wide range of operations including single or multiple spindle drilling, boring, reaming, counterboring, hollow milling and chamfering. Send us details about your job-problem. We'll be glad to show you how a Baker Machine will help you beat rising costs with an upswing in productivity!





● Here's multi-operation performance that results in high production! This example shows a Baker 36HO Vertical Hydraulic Feed and 7½AA Horizontal Units in combination with Multi-Spindle Tap Unit around power index table for multi-operations at one chucking of part. The work is a gear carrier in malleable iron, handled as shown by blueprints at left.

BAKER BROTHERS-Inc. TOLEDO OHIO

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SURFACE
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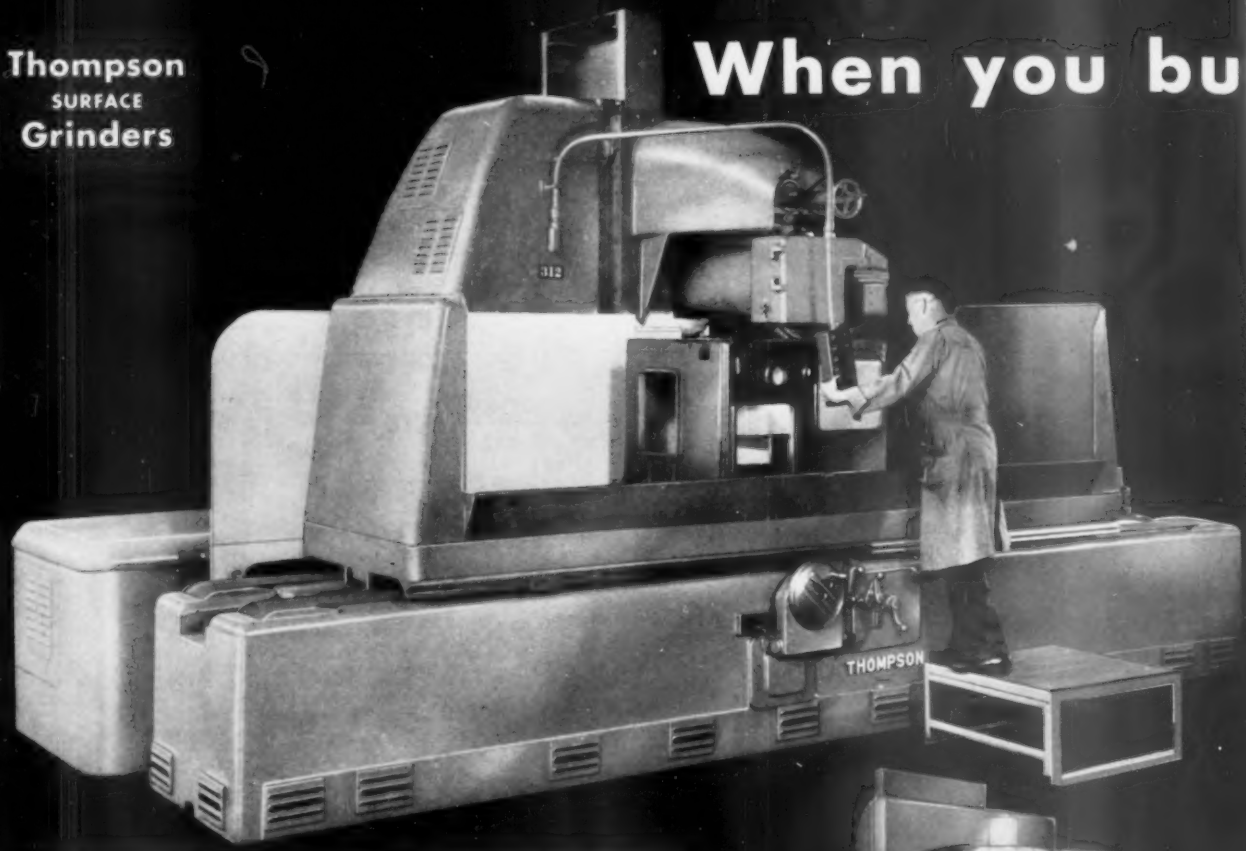

TYPE C — Large capacity, heavy duty, precision surface grinders for work 12″ to 36″ wide, 16″ to 48″ high, and 40″ to 240″ long. Cutting feed range of 10 feet to 100 feet per minute. Automatic hydraulic feeds to head and table.

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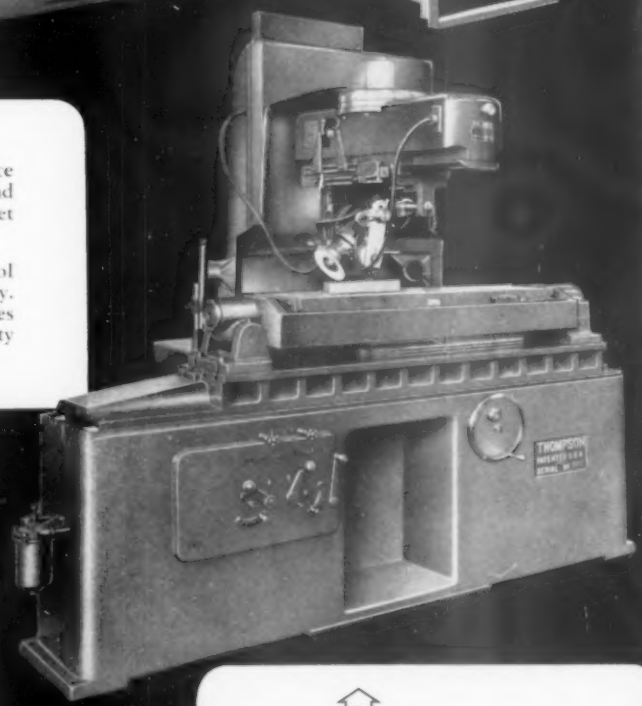

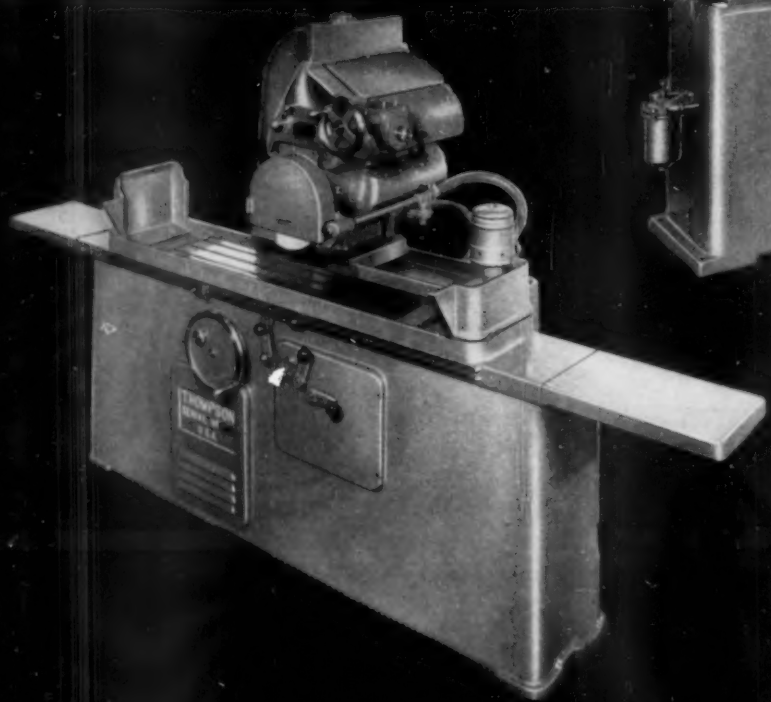

BROACH GRINDERS in sizes 6″ x 48″ to 12″ x 72″ for flat or round broaches — gumming and relieving. Heavy duty and fully automatic. Electric locator guarantees accurate tooth spacing.

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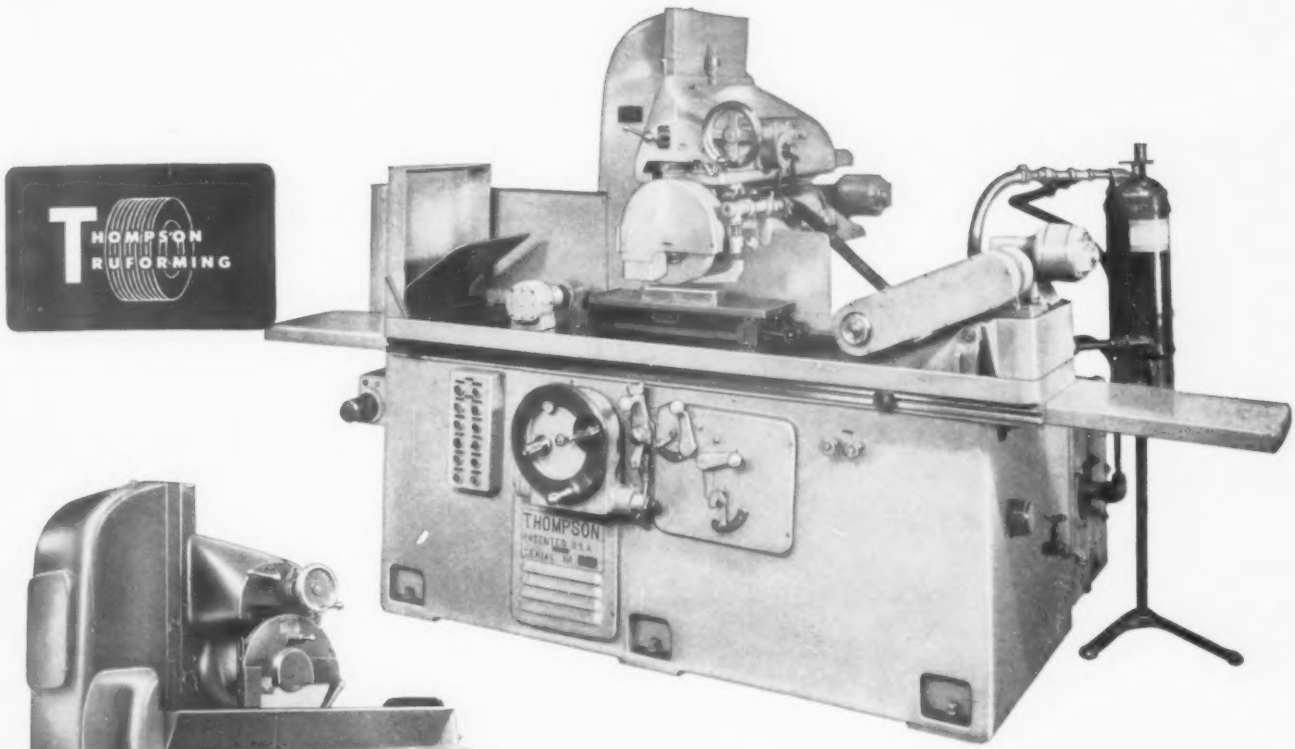

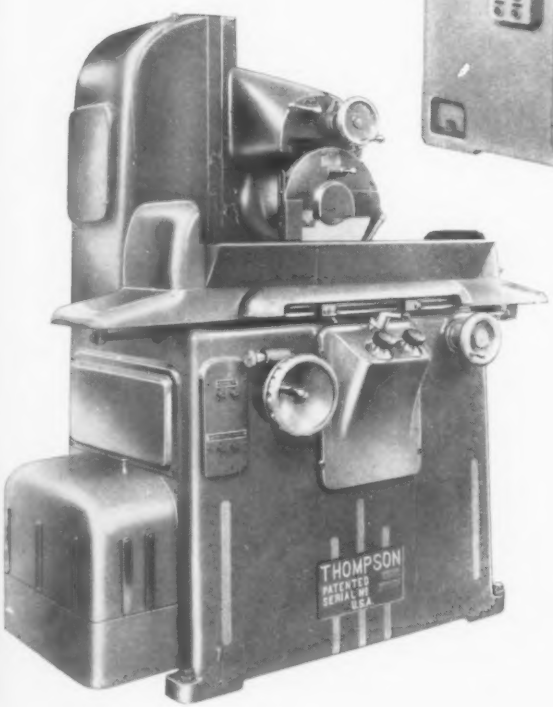

TRUFORM GRINDERS (Crushed Wheel Form Grinding) — Thompson Truforming Grinders are completely engineered units with *two* crushing rolls permitting practical production of precision flat form contours for the first time. Standard machines for forms up to 6″ width available.

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One Answer

A NEW AND UNHEALTHY philosophy has crept insidiously into the minds of many of our production workers. Boiled down to simple and understandable terms, this new doctrine is but a variation of the old fallacy of "getting something for nothing." The only difference is that today, more than ever before, applications of this thinking are beginning to destroy our standards of living . . . to eat into the very core of our economic system.

What is this evil thing, and when did it start?

Last summer, one of America's largest mass manufacturers reported, after considerable research, that labor efficiency in this company's plants was down about twenty per cent. This was a trend that had been growing since early in the war.

Without comment, a study of statistics will provide the answers for the "what" and "when" of this evil. But what we should be concerned with here is "why" and "how" . . . why it developed, and how are we going to combat it. The reason why we must seek carefully the answers to the latter questions is that there has been not the slightest indication that the trend in productivity per man-hour is on the upgrade.

Some observers are inclined to attribute the present state of low worker productivity to a general restlessness which, they say, is the result of the aftermath of the war. This may be partially true. But more realistic observers lay the blame on subversive and outside influences that are deliberately and with calculating cunning trying to sabotage our whole economic and industrial system.

As a matter of fact, no one knows definitely all of the reasons behind the declining productivity per man-hour among workers. The elements mentioned are certainly contributing factors. What we all know, however, is that something must be done to remedy the situation if we are to continue to raise our standards of living . . . if the American enterprise system is to continue to provide for its workers the highest pay, best living conditions, shortest hours, best working environment and maximum happiness.

National surveys are conclusive and convincing on at least one point: that production workers can be influenced by management's educational efforts as well as by those of other forces. It follows naturally, then, that it should become management's responsibility, and incidentally, the responsibility of management's key men, to lead its workers out of the wilderness of low productivity. Tool Engineers, being the important representatives of management that stand at almost dead center between management and the workers, should play a vital role in this important educational effort.

Tool Engineers are in a position to render a great service to this cause . . . because this job can't be done by high-sounding preaching. Mere words are empty. It must be done by example. Every department of management must be geared to guiding and directing . . . to showing graphically to every worker the simple and basic economic fact that he cannot possess that which he does not produce. Reduced to simpler language, "he cannot have his cake and eat it too."

Idleness and low productivity are the breeding grounds for unemployment. Honest work and high productivity are the parents of jobs. Each time the cost of an item is raised by idleness and low productivity it means lower real wages and, hence, less purchasing power.

Show the worker these things which are as basic as the steel in a lathe . . . as American as apple cider, and he will recognize his duties, fulfill his moral obligations and assume his economic responsibilities. Because he, too, is an American.

But remember: show him in a kindly way, patiently and adequately. Don't just preach!

Am Largent

President 1946-47

By Fred M. Burt

Tools and Techniques for Truck-Trailer Production

Straight Line Flow and Continuity of Movement Are Major Factors in Speed and Efficiency of Production

THE LATEST PHASES of expansion, and extensive improvements of production facilities, at the large Los Angeles plant of the Fruehauf Trailer Company of California, present many very interesting changes in plant layouts, equipment and methods. These changes are now at a point where they may be released for publication, with the three main production line flows—Stainless Steel Trailers, NPS Trailers (narrow pressed steel frames for stake and rack bodies), and aluminum-panelled Aerovan—described with varying degrees of thoroughness. This article, then, will deal with operation sequences, with some coverage of the manufacture of the huge carryalls, and special units.

Mr. Burt

While continuity of movement, from one processing operation to another, is a major factor in the speed and efficiency of production, it is not necessarily the most important part of the fabrication scheme. While there can't be much diversity of method in moving such large units, from one work station to another, a most interesting study is presented by the diversity and efficiency of operations at these work stations (stationary and moving); e.g., the feeding of supplies and subassemblies; the tools used to do the jobs; and the total coverage of working areas by rail, monorail system, and auxiliary lines.

FIG. 1. The machine shop, equipped with about 50 machine tools of various types, where machined parts used for the trailers are fabricated.

FIG. 2, below. Natco 16-spindle hydraulically operated multi-drill, used to drill six holes in brake drums. Air operated chuck is self centering.

Most of the production is centered in the plant's main building which, with recent additions, is 1171 ft. long from east to west, and 171 ft. wide—or over 185,000 sq. ft. of manufacturing and storage space under roof. The Aerovan line runs nearly the full length, close to the north wall, and the NPS line runs from east to west, past the 12 ft. center aisle and adjacent to supplying departments. It ends about midway, when the stainless steel line starts.

The supplying departments (see Figs. 1 & 2) run from east to west, with an outside platform paralleling a railway spur, and include cutting and oxygraph, truss material storage and fabrication, main tool crib, machine shop, jig and fixture department, woodworking department, compressor and transformer rooms, a covered stockroom with a truck well, and an open dock storage area.

Start of Narrow Frame Production

Narrow frame production starts with two main holding fixtures, side by side, where the heavy side rails, trusses and smaller parts are welded and riveted together. Nearby are work stations for subassemblies. This line is served from overhead by two, 2-ton hoist bridge cranes with Louden monorails 24 ft. apart.

Parallel and adjacent, in the center, three other monorails carry four, 3-ton hoist bridge cranes, 40 ft. long. Next to it,

In this account of truck-trailer production at the Fruehauf Trailer Company of California, Mr. Burt is to be highly complimented for the remarkable pictorial sequences which, with the captions, are almost a story in themselves. Photography is by A. R. Hromatka of Los Angeles.

The Editors

FIG. 3. Start of operation of the NPS (narrow pressed steel) frame production line. Note the bridge cranes.

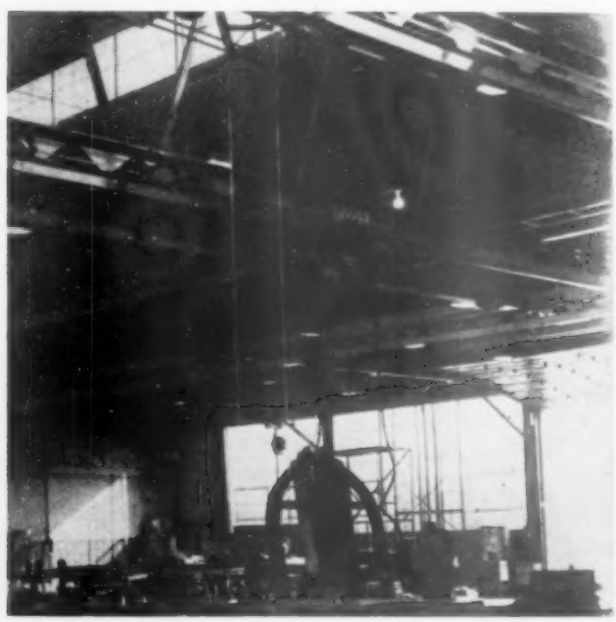


FIG. 4. No. 10 Chicago Pneumatic Squeeze Riveter, with attachment for punching holes in chassis side rails.

and over the Aerovan line, is another 24 ft. span carrying cranes with seven, 3-ton hoists. Interlocking devices—i.e., switches—allow the movement of hoist carriers from cranes in one line to those in the adjoining line. Cranes, hoists and their carriers (see Fig. 3) are all electrically operated. Wright, Budgit, Metcoy, and Yale & Towne hoists are used.

Portable Tools for Hole Punching

Holes for rivets to ½" diameter are punched in the frames by portable tools, and the rivets are also squeezed by using the one type of tool but with different punches and anvils. This highly satisfactory innovation (Figs. 4 & 5) consists of No. 10 Chicago Pneumatic 34-ton Hydraulic Squeeze Riveters. These riveters have adjustable pressure with a 1,000 psi maximum low pressure, which is built up by a booster, in the hydraulic power machine, for the final squeeze.

The 32" to 36" wide narrow frames move on to two tumble weld fixtures, through the trussing station, fifth wheel assembly station; then, leaving the overhead monorails, each unit is placed upside down on a roller conveyor, 180 ft. long. This carries them, slowly, for the installation of axle assembly, tires, springs, tire carrier, wiring and other units. These subassemblies are made up in areas alongside the work stations where they are applied. The last assembly to be added, before coming off the conveyor, is the gravity torsion underconstruction. This unusual torsion rod springing completely eliminates leaf springs, and to good advantage. See Fig. 6.

With wheels and tires attached, after hoisting from the end of the conveyor, and turned over to rest on its own wheels and forward dollies, the chassis is moved along by a floor-chain puller. First, the steel floor framework, which has been fabricated on nearby jigs (including the twin, tumble, final welding jigs) is attached to the chassis.

The woodwork, and other parts of the stake and rack or flat bed bodies, is next applied. See Fig. 7. While production is continuous, successive units may differ, or there may be several of the same type. Inspection on this line (and the others to be described later) is progressive, with an inspector assigned to the number of operation sequences which he can conveniently cover.

Straight Line Flow Predominates

Further on, in the same straight line flow and past a 22 ft. north and south aisle, and adjacent to a side assembly area, is the first stainless steel trailer welding fixture. See Fig. 8. Here the four wheel and tire, torsion rod springing, and cross member underconstruction assembly is prepared and moved into one end of the fixture, shown in Fig. 9. The pre-fabricated stainless steel sides are picked up, moved over and lowered into place with bridge cranes and hoists.

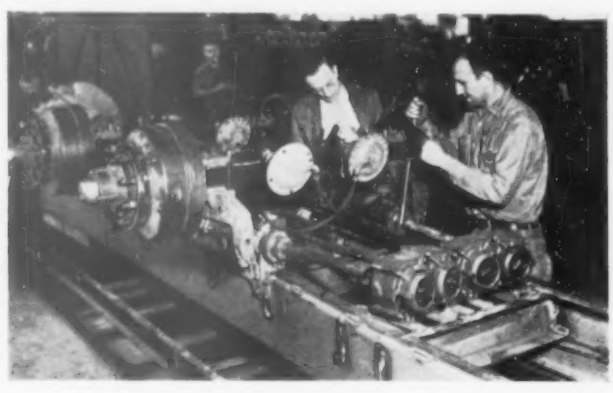
The stainless steel sides, and tops and front ends used to complete the trailers, are manufactured from extruded shapes by the Edward G. Budd Mfg. Co., Philadelphia, using the same shot weld (resistance welding) process now used at these Fruehauf welding stations. They are shipped, 30 sets to a gondola, and unloaded into storage stacks with a 10-ton, 45 ft. boom, self-propelled General Super-Crane. From here they are loaded as needed, two sides, for instance, at a time onto a special "A" frame, four wheeled, rubber-tired truck for towing to point of use by one of the plant's tow units.

After positioning the various parts of these trailers, and clamping them immovably into precise location, the work in the three huge welding fixtures is principally that of making thousands of "shot welds." These are applied in many positions by a variety of hydraulically-operated, Progressive Welder Company Hydro-Booster resistance welding units with General Electric controls. This shot weld process is the same as that used by the Budd Company in the construction of railway coaches.

With its high tensile strength of 150,000 lbs. psi, an assembly of stainless steel parts, joined by malleable rivets, will not maintain a proper strength at the points of jointure. Rivets that have a commensurately high shear value are too hard to be driven, and ordinary spot welding is equally inadequate for joining stainless steel. The more rapid shot welding provides adequate strength, insures uni-

FIG. 5. Squeeze riveter used to assemble hanger fittings to side rails. Note the poised swivel, for balance.

FIG. 6. Torsion rod springing unit assembled with an NPS chassis on the roller conveyer line. Frame is moving upside down.



formity, size and shape of the welds, and provides proper controls to maintain the uniformity, even though the welds are hidden.

Test welds are first made, joining small pieces of stainless steel of exactly the same thickness as those to be used in all of the production welds. The same machines are used with the settings for tip pressure and current, with the electrodes conforming to recommendations of the "Shop Stainless Steel 18-8 Welding Chart." See Table I at end of article. Then these pieces are tested on a Vickers Tensile Tester (Fig. 10) to make certain that the machine setting and operation is such that the resultant weld strength exceeds the pull required to shear the welds.

As the production welding progresses, the strength of each weld is recorded at a G-E Thyratron Control Station. The recorder draws a line on a paper tape, and the length of the line indicates the strength of the weld. There is one line for each weld. If the line is too short, the weld is weak; if too long, the weld is over-sized or possibly burned. With any material departure from the proper length, the recorder causes a bell to ring when, if a new setting is not made promptly, the current is automatically cut off.

Besides the main sections, the upper coupler and supports, cross members and other parts are placed and fixed; then, welding can proceed in several places, using different guns, variously hung from overhead and easily moved to the proper welding positions. Some of the guns are hung from Thor balancers. While one man is welding the outside (see Fig. 11) others operate inside. The front section is welded to the side panels with two Progressive Welder Company C-type guns, the largest deep-throat guns ever built. See Figs. 12 & 13.

Height Adjustable Platforms

In the second fixture, ten, hat shaped section stainless steel floor stringers are installed, with each one welded to the cross members. See Fig. 14. In the third assembly fixture, the roof is shot welded to the side and nose sections. Outside welders work from side platforms and a removable front end platform. See Fig. 15. For inside work, a long platform, height-adjustable and carrying a welding unit on a track—Fig. 16—is run into the trailer and adjusted to the working convenience of the welders.

After leaving this station, a strong, lightweight, aluminum lining—Fig. 17—finishes the interior from floor to roof, held by screws inserted in each vertical upright. This is further insulated, as shown in Fig. 18, for refrigerator vans. This easily replaceable lining provides a maximum protection for both cargo and the load-carrying side sections of the unit. Hardwood floor boards are installed between the ten stringers, and fastened to cross members with special steel screws. Outside, a special fixture holds the full length rear doors while the hinge pins are installed, with no lost time,

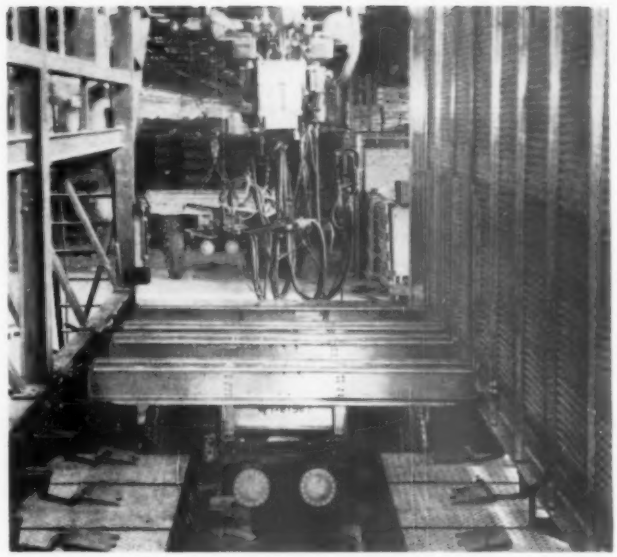


FIG. 9. Underconstruction, and one stainless steel side, in the first shot welding fixture. Progressive Welder Hydro-Booster resistance welding unit, shown suspended, in the background.

for a tight, waterproof fitting. After these installations, the trailers are about ready for use, as the non-corrosive stainless steel doesn't need a paint job. Three or four of these trailers are produced in the eight-hour day.

The Aerovan production line, with a present capacity of two trailers per hour, is the longest, occupying a space 80 ft. wide north of the center aisle. First, there is an area for working stock and parts' storage, and a variety of subassembly jigs with their incidental tools. Next—Fig. 19—is the main frame jig, opposite the subassembling of cross members.

The main frame is picked up by overhead hoists and moved to one of the two final weld tumble jigs, where further welding and installation of other members is effected. Then, the chassis takes form, upside down. The axle and spring assemblies are attached, after having been formed in crossways travel in the subassembly area, and piping and wiring comes from benches next to the wall.

Accessories Assembled on Conveyor

The chassis is then placed on a roller conveyor—Fig. 20—to be pulled along slowly by a variable speed drag chain. While traveling about 130 ft. on this conveyor, the chassis acquires certain supports, rims, wheels, tires, tubing and other (minor) parts. Each of these parts comes from lateral storage and pre-fabrication areas; for instance, paint is sprayed on in a drum and wheel spray booth, as shown in Fig. 21.

FIG. 7. End of stake and rack (NPS frame) production line, showing nearly completed units. Compressor and transformer rooms in center background.

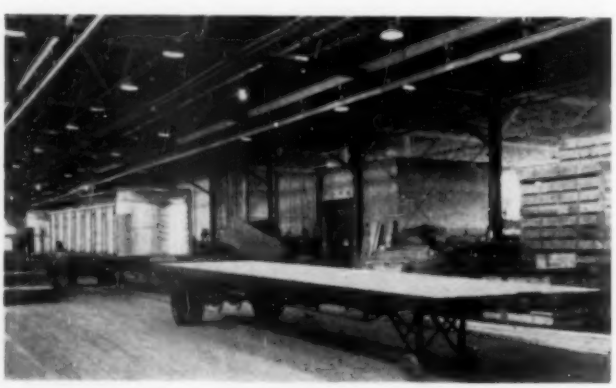


FIG. 8. Stainless steel trailer underconstruction unit ready for placement in first welding fixture. Members have been located and clamped.

FIG. 10. Bob Gurney, Stainless Steel Welding Inspector, testing shot welds, rear cross-member reinforcements, on a Vickers Tensile Tester. Required pull, for these members, is 9000 lbs.

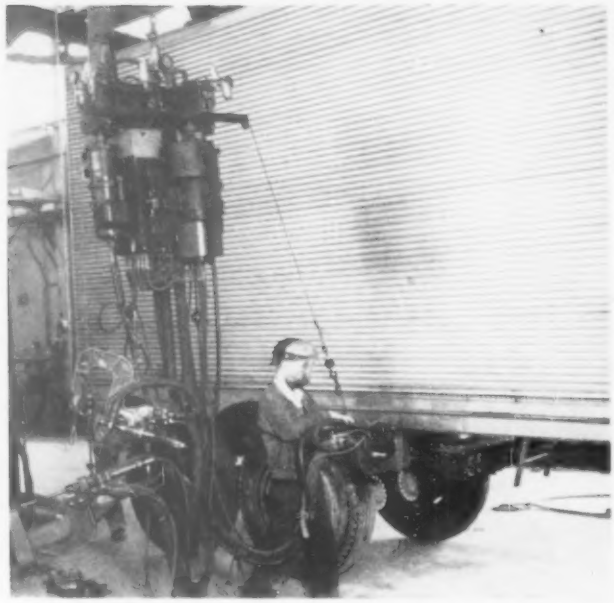


FIG. 11. Shot welding, on the outside of trailer assembly, in Fixture No. 1. The guns, hung from balancers, are provided with varying throats and gaps for welding in many positions.

At the end of this double roller conveyor, the chassis is ingeniously hoisted and turned over, as shown in Fig. 22, to be set evenly on its wheels and a fifth wheel dolly. A little farther on, the trailers are centered up over a floor drag chain which travels, in a slot in the cement floor, at the rate of 14 inches per minute. This speed suffices for the present production of two Aerovans per hour. An attaching fixture hooks on to the chain and to the front end of the fifth wheel dolly.

All Welding Done in Jigs

Moving through the Skeleton Department (Fig. 23), front and rear end frames and sides and tops are located and clamped to the chassis, and then are welded to it. Rear doors are also attached. All of the framework is assembled and arc welded into form on several jigs alongside the line.

The Aerovan frame is cleaned manually, as required, with sand paper and solvent, and then moves into a 40 ft. long, 16 ft. wide and 12 ft.-8 in. high Acme chassis spray booth, built by Acme Associates, Inc., Los Angeles. Two, 20 ft. long water wash units on right and left sides, in staggered arrangement, pull out the off-spray of chassis paint. Each unit is exhausted with a master blower having a capacity of 32,000 cfm at 1½ inch static pressure, and 125 fpm average face velocity across the working areas.

Beyond the booth, the trailers pass between two elevated platforms, shown in Fig. 24, where the upper panels of 24 ST Duralumin are attached and the rolls of roofing sheet (one to a trailer) are hoisted and then unrolled on the roof framework. Panel work is also done from floor level while the hardwood flooring is being installed between the stringers, the same as in the stainless steel trailers.

This work continues through an open area; then the trailers pass again between elevated platforms where a 35 ft. long framework is lowered on to the roof to compress and position it. Chains, suspended on each side from the jig, are attached to the chassis and tightened with ratchets. The roof

FIG. 12. The front end positioned in No. 1 welding fixture. Two huge, deep-throated guns can be suspended above, one on each side. Operators stand on elevators to reach different levels.

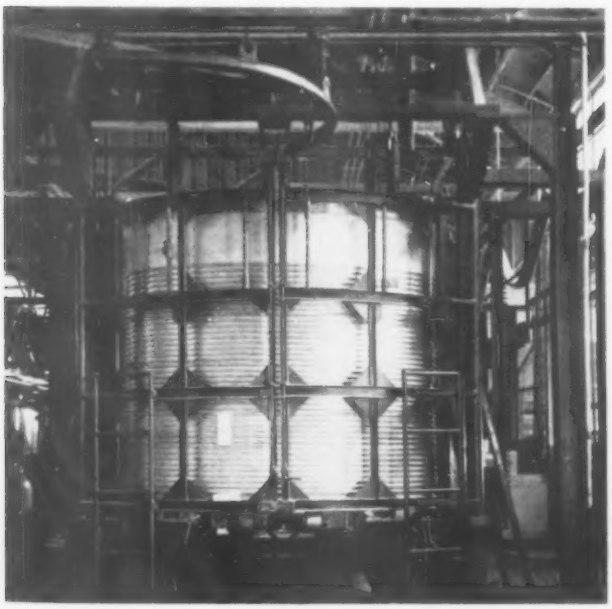


FIG. 13. This welding gun, manufactured by Progressive Welder Company, Detroit, is one of the biggest resistance welding C-type guns ever built.

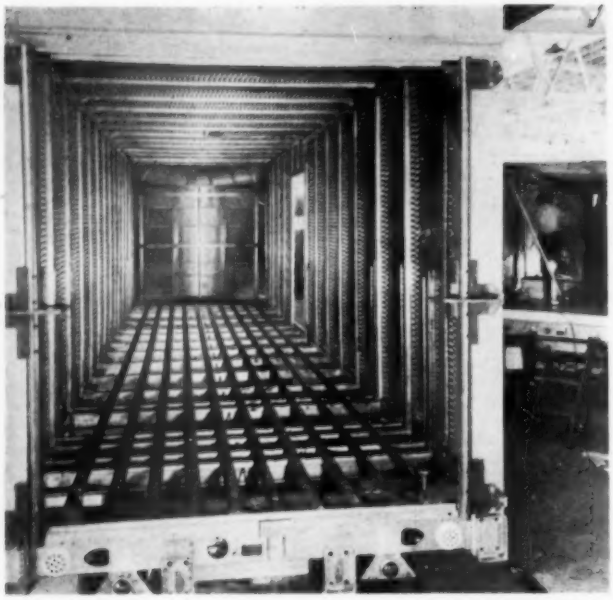


FIG. 14, at left. Trailer in second fixture, showing the floor stringers shot welded to the cross members. *At right in same photo,* workers are insulating a "reefer," or refrigerator van.

FIG. 15, above. Welding the tops of the sides. The gun in use is a Progressive scissor type gun, with a C-type suspended close by. All guns are suspended on spring balancers. Knu-vise clamps hold the work during welding.

is then nailed down. Next, side molding is attached with screws, and the front and rear caps and decorative wings are positioned and attached with molding, bands and screws.

Spray Booths Adequately Illuminated

About 180 ft. further on is the finish spray booth, where travel side doors are hung, together with other outside work; then, the Aerovans pass between cleaning scaffolds where workmen clean off rust spots and other blemishes with sand paper and emery cloth. All surfaces to be painted are wiped clean, with cloths soaked in a special solvent, to obtain complete cleanliness. A similarly applied bath of a special acid has an etching action on the duralumin to promote adherence of the primer coat.

The finish spray booth, also designed and built by Acme Associates, is 75 ft. long, 18 ft. wide, and 18 ft. 10 in. high, with 10 ft. wide openings. See Fig. 25. A fast-drying, reddish-brown, flash primer is first sprayed on, followed by two synthetic cover coats in the colors specified. The trailers are disengaged from the chain for most of the side and top spraying of primer coat.

For front and back end spraying, the spray painter rides a double ladder, joined at the top in "A" shape and mounted on wheels to be pulled along by the chain. At each end are stationary, grillwork platforms, with sets of swinging platforms above, on two levels and on each side of the space occupied by the trailers. See Fig. 26. The three coats, which can be applied in 45 minutes or less, use a total of about 2½ gallons of paint.

The booth is illuminated by seventy, 500-watt incandescent lamps, 28 on each side and 14 on top, with the light beams passing through wire glass windows; hence, no off-spray can settle on the lamps. Deposits on the insides of these windows is easily removed by wiping with a solvent impregnated cloth.

Off-spray is removed from the working areas in the booth by a strong downdraft through the 3 ft. wide grill, running lengthways in the center of the floor. The booth is divided into three, 25 ft. sections with the downdraft in each provided by a heavy duty blower with a 46,200 cfm capacity at 1½ lbs. static pressure. With a trailer body in the booth, there is an average 150 fpm downward face velocity.

All Off-Spray Eliminated

After passing downwards through the grill, the off-spray in each section is pulled to one side, past the edge of the booth, and through a tunnel. It then passes up through a strong downward directed water spray from nozzles in a horizontal pipe or manifold, then up over the top of a steel water curtain, down through another water spray, and finally up through eliminators, where the last vestige of off-

FIG. 16. Inside welding in Fixture No. 3. The resistance welding unit runs on a track on the adjustable height platform which projects from a heavy dolly outside. The dolly, in turn, runs on a lateral track, and can be moved to other trailers.

FIG. 17. Attaching the inside aluminum lining with special screws while the hardwood floor is laid between the longitudinal stringers.

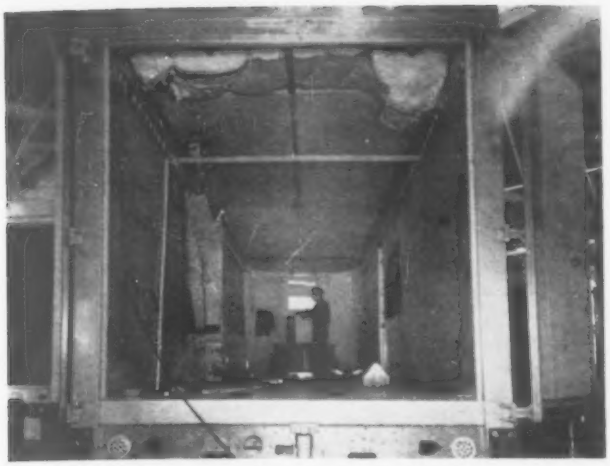


FIG. 18. Closeup of reefer interior, showing application of insulations and plywood inner lining. This will be a refrigerator van.

FIG. 19, right. Start of the Aerovan line, showing subassemblies in the main frame jig. Tumble jigs shown in background. Laterals in the overhead tracks permit hoist carriers to move from craneway to craneway.

spray is eliminated. A duct runs from each set of eliminators to a blower from which a 40 x 52 inch duct leads up through the roof. The water, washing off-spray out of the exhaust stream, carries it down into a 2200 gallon tank for recirculation.

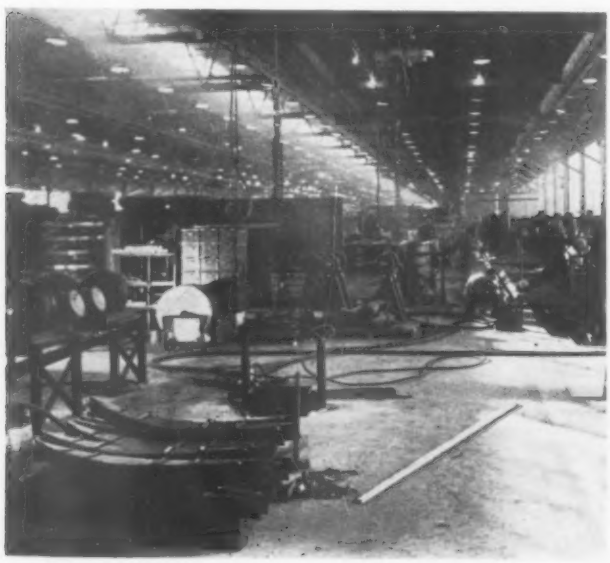
Paint Particles Precipitated

At the start of operations, the tanks full of fresh water are each given an addition of about 44 lbs. of deflocculant compound, with a subsequent addition of 4 lbs. per eight-hour working day until the condition of the water requires a draining and fresh start. When the particles of paint are washed out of the air and precipitated into the deflocculator solution in the collecting tank, the oil and resinous vehicles are readily emulsified and the pigment thoroughly dispersed.

In other words, the flocculent masses (aggregate or compound masses of particles) are separated into non-flocculated masses or particles—i.e., reduced to what is supposed to be a molecular state of subdivision. Therefore, they cannot deposit on the metal walls, and the cleanliness of all parts of the water system is thus maintained.

Water is recirculated through the washing units by three, 565 gpm pumps at 65 ft. head, driven by 15 hp motors, and

FIG. 20. Springs and axles, at left and adjacent to the Aerovan chassis to which they are attached. At right is the start of the power driven conveyor on which additional units are added as the line moves.



located in pits. There are also three cleanout pits with removable, airtight covers. For fire protection in this (and the other two) spray booths, there are two rows of sprinkler heads overhead; also, hand operated, foam type extinguishers at several convenient points for use in case of possible fires of electrical origin.

A few feet past the finish spray booth there is a paint baking oven—Fig. 27—70 ft. long, 11 ft. 6 in. wide and 16 ft. high. While originally designed with doors on each end, these created considerable inconvenience, which was eliminated by resort to a heat seal at each side of both ends. Hot air, under high pressure, is introduced into the vertical ducts at each location. From narrow slots on the inner edges of the ducts, the hot air is projected at an inwards angle towards the center line where the two sheets of hot air meet to form a V, with the apex pointed inwards. This hot seal stops the outward travel of hot air so that while room temperature prevails, outside of the dryer, the desired baking heat is maintained inside.

FIG. 21. Acme special water wash spray booth for wheel and drum painting. Complete elimination of off-spray from exhaust stream in water wash unit obviates need of exhaust duct which could not be used due to overhead crane travel. The heavy, upper, counterbalanced roller is raised to allow rolling wheel on to the lower rollers. The rear roller, motor-driven, is controlled by either of two treadles, in the front at right and in the rear at left. A hand, lever-operated ejector between lower rollers pushes wheel out when painting is completed.

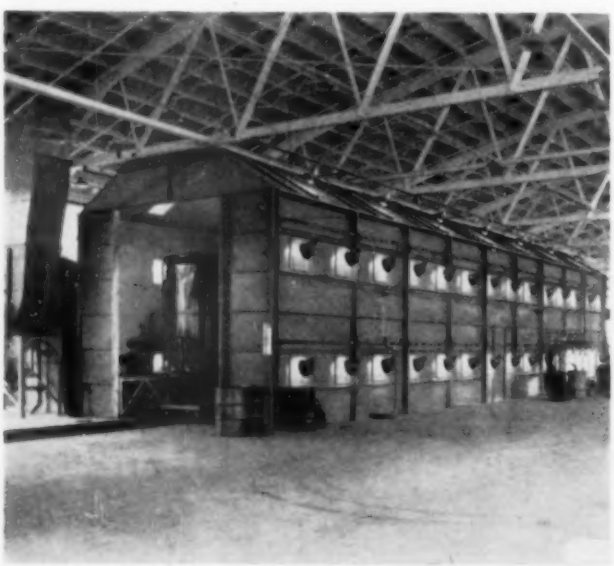
FIG. 22. Aerovan chassis at the turn-over station. Note spring and hook attachment at the right. This cable runs to a 2-ton hoist on a monorail. As this side of the chassis rises the other side pivots on the attachments on two hydraulic cylinders. These rise to a proper height to allow the turned-over chassis to drop evenly on the floor on its wheels and a fifth wheel placed to receive it. The cable running off to the right is attached to a hand-operated drum to retain a too-rapid drop. All controls are together at the right.

FIG. 24, right. Unrolling top sheets and attaching aluminum side panels. Operators work on platform, of convenient height, located just past the chassis spray booth.

Hot air is also introduced through rows of small ducts on each side, just below roof level, and at a lower level through slots in the lower edges of longitudinal ducts. Air is drawn out through ducts close to the floor, for recirculation through the heater, plus a certain amount of fresh air picked up from outside openings. The oven exhaust fan is operated with a 2 hp motor, while a larger blower with a 7½ hp motor supplies air to the indirect type heater. Four Maxon Premix, gas-fired burners shoot their hot products of combustion into refractory-lined burning chambers, around which the air to be heated circulates rapidly.

The whole operation is automatic, following predetermined settings on the control panel. Starting with spark plug ignition, the air volume, velocity and heat input (up to 2,500,000

FIG. 25. Acme 75 ft. finish Spray booth, built by Acme Associates, Inc., Los Angeles. Note the large number of 500-watt lamps used to illuminate the interior of the booth. Wire glass windows protect lamps and provide easy cleaning.



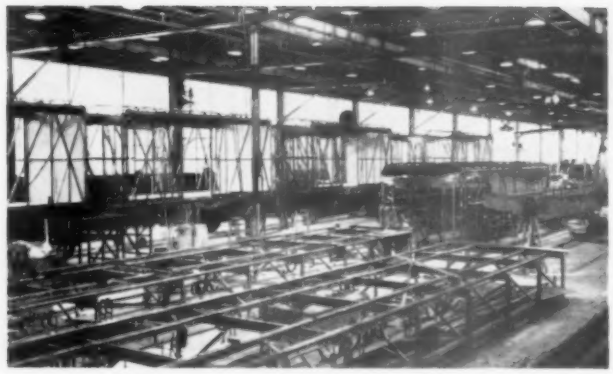
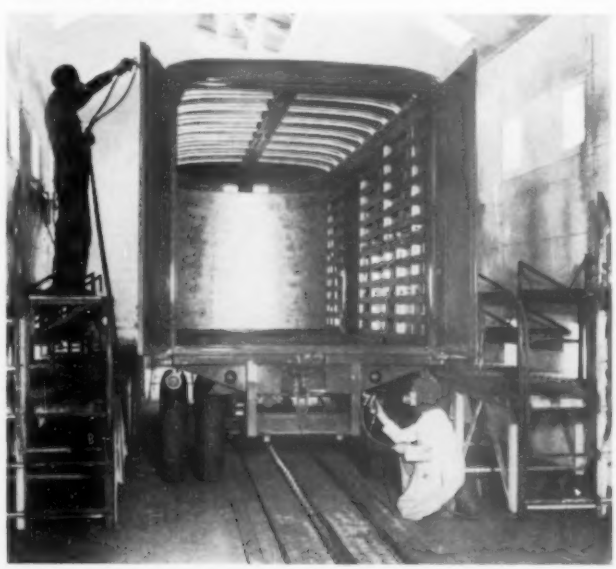


FIG. 23, above. End, side and top framework assembly in welding jigs. They are next moved, by overhead monorail system, to the Skeleton Department at rear, for attaching of the chassis.

B.T.U.'s hourly) is maintained as a constant. Two Foxboro recorder controllers attached to two thermocouples, inside the unit, show from their charts that the air from the heater for input is kept at from 270 to 300 degrees F., and that the temperature in the upper central part of the oven is kept at from 179 to 188 degrees F.

Leaving the oven, the trailers end up at a "touch-up" station. After that, it is a completed end-product, as shown in Fig. 28. Beside the oven, another 40 ft. water wash spray booth (an approximate duplicate of the chassis spray booth), shown in Fig. 29, is used for painting stake and rack trailer chassis, converter gears, and special jobs. In a large area

FIG. 26. Finish coats being applied with Binks spray guns, of which there are eight. Note the stationary, and swaying platforms for convenient working heights. Off-spray is carried away by strong downdraft through floor grilles.



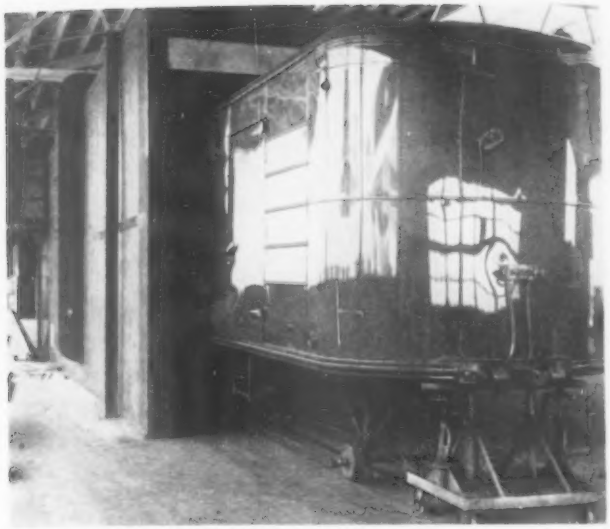


FIG. 27. Aerovan coming out of the 70 ft. baking oven.

FIG. 28. The end product of the Aerovan Production line.

between the Aerovan and Stainless Steel lines, trailers are placed for modification work.

In a large, rear area is located the carryall and heavy fabrication building, 300 ft. x 75 ft. in area, served from end to end with a full width span 10-ton crane. Equipment includes heavy duty shears, cut-off saws, an Arco oxygraph and considerable welding equipment. The final welding on the huge carryall frames is done on a big tumble (rollover) jig, shown in Fig. 30. The standard Fruehauf carryalls have capacities of from 10 to 74 tons; while larger, special units may run to 125 tons capacity, with 32 wheels.

Located at one side of the building—Fig. 31—is a continuous production line for converter gears and other special units. On the other side of the building is another Acme water wash spray booth, 40 ft. long, of the same design as the Aerovan finish spray booth. It is used for painting carryalls, logging and pole dollies, and other units constructed in this building. Near it is a high speed Kling friction cut-off saw—Fig. 32—turning at 1760 rpm, which can cut through a 10 inch channel of mild steel, averaging ½ inch in thickness, in about five seconds.

FIG. 29. Acme water wash spray booth used to paint stake and rack chassis, and converter gears. This is a duplicate of the Aerovan chassis spray booth. Note the staggered 20 ft. long water wash units at right and left.

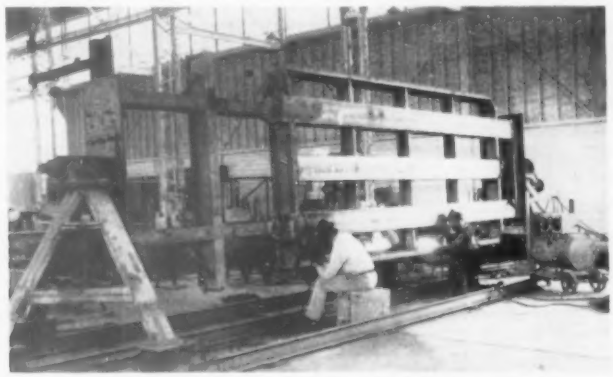


FIG. 30. Large tumble (rollover) jig used to weld large carryall chassis. This jig is nicely balanced so that the chassis may be readily rotated for most convenient welding positions. One end is adjustable.

FIG. 31. Assembly line for converter gears in the carryall and heavy fabrication building. Note that the chassis in foreground is inverted.

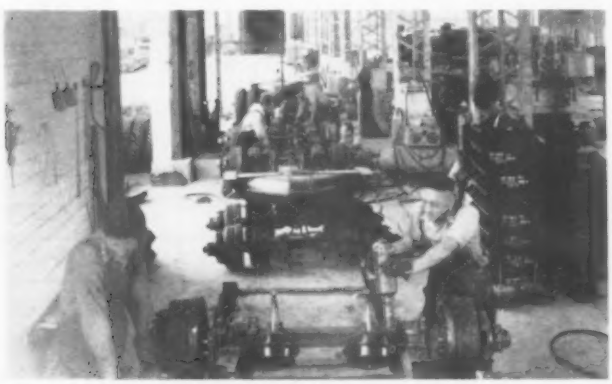


FIG. 32. Kling Friction Cut-off Saw, capable of cutting off a 10" mild steel channel in about 5 seconds. The saw, 52" in diameter, runs at 1760 rpm.

Intra-plant transportation units include six Automatic Transporters, two Automatic 3-ton lift forks, a 5th wheel high lift, two Automatic 1-ton forks, two 5th wheel "jeeps," four Divco (milk wagon drive) trucks, three 3700 lb. Clark fork trucks, two Baker-Raulang battery electric "jeeps" and two Ready-Power gas-electric "jeeps." The "jeeps" are tow units used largely to move trailers on their own and fifth wheels.

Welding, in various forms, is so widely used, in the Fruehauf modern techniques of trailer production, that the Fruehauf slogan of "Engineered Transportation" could well be supplemented with "Welded Transportation."

FIG. 33. Close-up of the Kling Friction Cut-Off Saw shown in Fig. 32. Note the heavy guard and the flood cooling used to prevent overheating. BELOW, welding chart for stainless steel.

TABLE I

SHOP STAINLESS STEEL 18-8" WELDING CHART LAB.—5D

Thickness of Thinnest Outside Piece, "T"	Electrode Diam., Inches	Tip Force	Gauge psi Tool	Time** Cycles	Minimum Weld Strength (Single Spot Shear) Pounds		Approx. Weld Diam. Inches	Minimum Lap, Inches	Minimum Flange Width Inches		Minimum Weld Spacing Inches				Thickness of Thinnest Outside Piece "T"
					L.T., S.T. M.T. D.S. *	H.T., V.H.T. F.H.T. *			L.T., S.T. M.T. D.S. *	H.T., V.H.T. F.H.T. *	"A" Type		B" Type	"C" Type	
											⟨ 2.5 T	⟩ 2.5 T	2-T 4-T	2-T 4-T	
.004	3/16	160		2	40	50	.040	3/16	7/32	7/32	1/8	1/8	3/8	1/2	.004
.006	3/16	180		2	85	100	.045	3/16	7/32	7/32	1/8	1/8	3/8	1/2	.006
.008	3/16	200		3	160	170	.055	3/16	7/32	7/32	3/16	1/4	3/8	1/2	.008
.010	3/16	230		3	200	250	.065	7/16	1/4	1/4	7/32	1/4	7/16	5/8	.010
.012	1/4	260		3	250	300	.073	1/4	5/16	5/16	1/4	5/16	1/2	3/4	.012
.014	1/4	300		4	300	380	.080	1/4	5/16	5/16	9/32	5/16	9/16	3/4	.014
.016	1/4	330		4	350	450	.088	1/4	5/16	5/16	5/16	3/8	5/8	7/8	.016
.018	1/4	380		4	430	550	.095	9/32	5/16	3/8	11/32	3/8	11/16	7/8	.018
.020	1/4	400		4	500	600	.100	5/16	5/16	3/8	11/32	7/16	3/4	1	.020
.022	1/4	460		4	580	700	.110	11/32	5/16	3/8	3/8	7/16	7/8	1	.022
.025	3/8	520		5	730	870	.120	3/8	7/16	1/2	7/16	1/2	7/8	1 1/8	.025
.028	3/8	600		5	880	1060	.128	3/8	7/16	1/2	15/32	1/2	1	1 1/4	.028
.030	3/8	650		5	1000	1180	.135	13/32	7/16	1/2	1/2	9/16	1	1 1/4	.030
.035	3/8	800		6	1280	1500	.150	15/32	1/2	9/16	9/16	5/8	1 1/8	1 3/8	.035
.040	1/2	900		6	1600	1850	.165	1/2	5/8	11/16	5/8	3/4	1 1/4	1 1/2	.040
.045	1/2	1050		8	1900	2200	.180	17/32	5/8	11/16	11/16	13/16	1 3/8	1 3/4	.045
.050	1/2	1200		8	2200	2600	.195	19/32	5/8	3/4	3/4	7/8	1 1/2	1 3/4	.050
.055	1/2	1350		10	2500	3000	.210	5/8	11/16	13/16	7/8	1	1 3/4	2	.055
.060	1/2	1500		10	2800	3400	.220	21/32	3/4	7/8	1	1 1/8	2	2 1/4	.060
.065	5/8	1600		12	3100	3800	.235	11/16	7/8	1-1/16	1	1 1/4	2	2 1/4	.065
.070	5/8	1750		12	3400	4200	.250	3/4	7/8	1-3/16	1 1/8	1 1/4	2 1/4	2 1/2	.070
.075	5/8	1900		14	3750	4600	.260	3/4	15/16	1 1/4	1 1/8	1-5/16	2 1/4	2 1/2	.075
.080	5/8	2000		14	4100	5000	.275	13/16	1	1-5/16	1-3/16	1 3/8	2 1/2	2 3/4	.080
.094	5/8	2400		16	5000	6300	.285	7/8	1	1 3/8	1-5/16	1 1/2	2 1/2	2 3/4	.094
.100	3/4	2600		16	5400	6800	.288	7/8	1 1/8	1 1/2	1 3/8	1 5/8	2 3/4	3	.100
.109	3/4	2800		18	6000	7600	.290	7/8	1-3/16	1 1/2	1-7/16	1-11/16	2 3/4	3	.109
.125	3/4	3300		20	7000	9000	.300	7/8	1 1/4	1 3/4	1 5/8	1 7/8	3	3 1/2	.125
.156	1	4000		15/6-4	9000	12000	.440	1 1/4	1-11/16	1 7/8	1 7/8	2 1/8	3 3/4	4 1/4	.156
.187	1	5000		15/6-5	11500	14500	.500	1 1/2	1-13/16	2	2	2 3/8	4	5	.187
.203	1	5500		15/6-5	12500	15500	.530	1 5/8	2	2 1/8	2 1/8	2-7/16	4	5	.203
.250	1	7000		15/6-6	16000	20000	.600	1 3/4	2 1/2	2 1/2	2 3/8	2 3/4	4 1/2	5 1/2	.250

NOTE: See Welder's Guide for welding procedure and for welding conditions not shown on this chart.

*For 1/4 H. use L.T., S.T., and M.T. values. For 1/2 H., 3/4 H. and F.H. use H.T., V.H.T., and F.H.T. values.

**For T greater than .125, use pulsation welding: on/off shots (Example 15/6-4).

By A. E. Rylander

Welding Fixtures for Mass Production

Simple Fixtures and Straight Line Flow of Materials Result In Ease of Operation and a Very High Production Potential

Third and Final Installment

IN THE PRECEDING INSTALLMENTS we discussed fixtures for a heavy weldment, and the advantages accruing from straight line flow of material in process. Yet, while a straight line may be the shortest distance between two points, it may not necessarily be the short cut to mass production.

For example, the assembly shown in Fig. 1—a front cross bar of an automobile frame which, by the way, is somewhat camouflaged—presented a number of problems although, on the face of things, the welding would appear to be very simple. And it was, as finally worked out.

One problem was the output which had to keep pace with a drawing press, making two hits per piece and running eight strokes per minute—a production of 4 completed troughs per minute or 240 per hour. And that is what complicated the program—the number of welders required to keep pace with this output.

As originally made, the assemblies were welded together in a considerable number of similar fixtures which, along with parts and supplies, took up a lot of valuable floor space. Also, the welding entailed an inordinate amount of repetitive lifting and handling which, while not particularly arduous since the parts were comparatively light, was nevertheless time consuming.

For example, each operator would pick up one of the troughs—to call them that—and lay it in a fixture. He would then pick up the two reenforcements, locate and clamp them. He would next tilt the fixture one way, weld one side, then tilt the fixture in the opposite direction and weld the other side.

The welding done, he would remove the assembly from the fixture and deposit it on a conveyor, after which he would "fish around" for parts for the next piece. All very time consuming, with the time per unit multiplied by the number of welders required to keep pace with the press output.

Various methods for improvement were considered, with straight line flow first in favor. The idea was to have one operator load, a number to do the welding only, and one operator to unload at the end of the line. The fixtures were to be attached to a continuously running chain, as shown schematically in Fig. 2.

While the assemblies were comparatively light they were nevertheless bulky, entailing heavy fixtures. Return would have to be through a trench, with the implications (1) that at least twice as many fixtures would be required as were actually needed for the job (of course those returning to loading position would be idle); and (2) that the weight on the chain would be so great that the fixtures would have to slide on ways. And that would have added to design complications.

From Straight Line Flow to Rotary Motion

In the final analysis, a "merry-go-round"—Fig. 3—was proposed, and with this deviation from straight line flow, the problems of space, handling and required output were solved. As a matter of record, it was a straight line flow setup to all practical purposes, as will be shown.

With this "tool," only nine operators—one to load and unload, and eight to weld—were required to keep pace with output. Except for the loader, all were comfortably seated during work; furthermore, only nine fixtures were required—one to each operator, and these were exact duplicates and therefore interchangeable. One extra fixture, carried as a spare, served as an emergency unit in case of possible breakdown.

Operation sequences are as follows: The troughs came from the press, in the direction of the arrows, Fig. 3, on a belt conveyor, and were shunted to a table immediately at the loader's right. Over this table, but not shown here, is another table for accumulation of the reenforcements—so

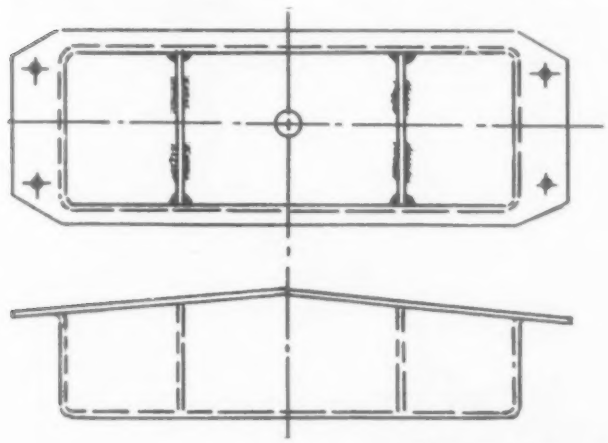
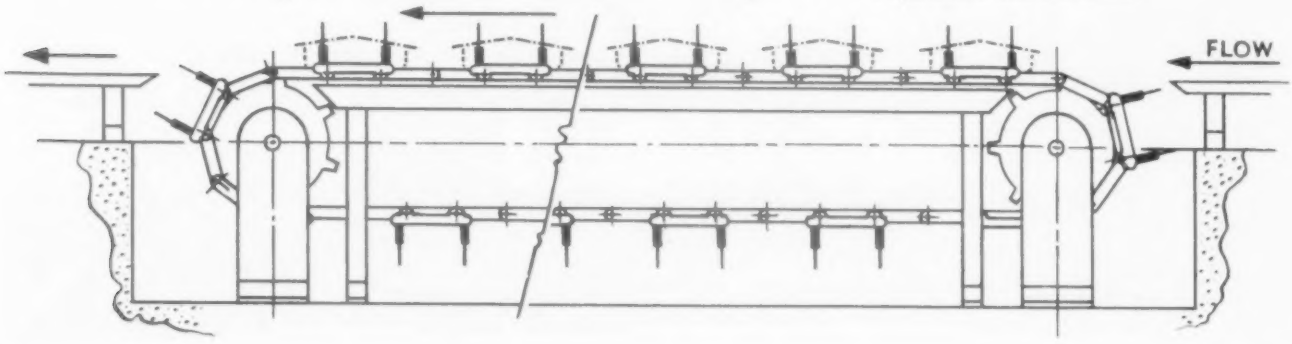


FIG. 1, left, the weldment. Two-sheet steel reenforcements are positioned in the "trough," clamped and arc skip welded, four welds to each side of the reenforcements. The trough is located on the fixture by the hole shown at the center.

FIG. 2, below, a proposed continuous welding machine or conveyor. Design rejected because it entailed too many idle fixtures and required 2 operators to load and unload.



that a quantity of the reenforcements, sufficient for an extended run, would be readily accessible.

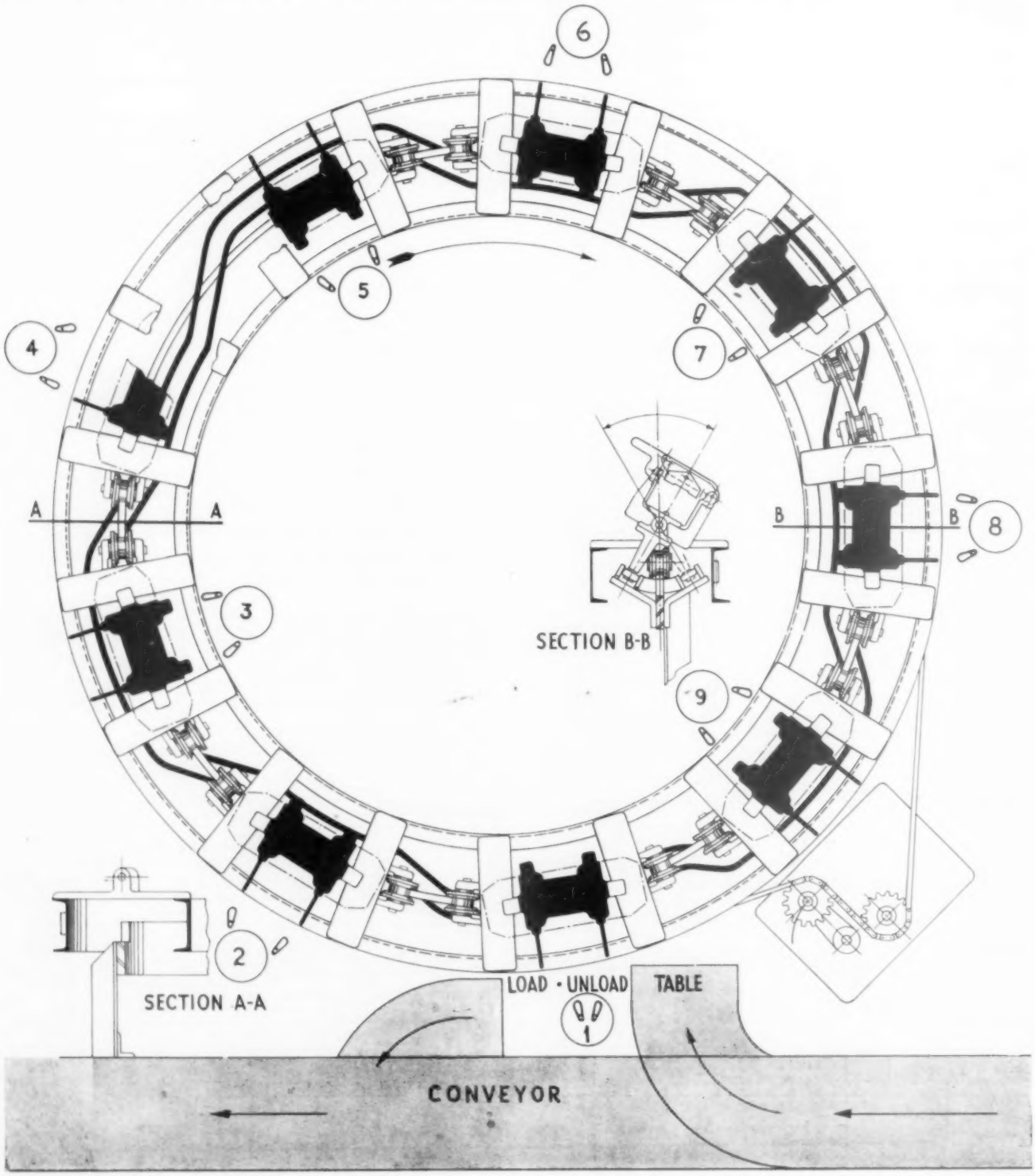
At start of operations, the loader—Station 1—would pick the troughs from the table, place them in the fixtures as they passed by and position and clamp the reenforcements. This would be repeated until all nine fixtures were loaded. By the time the first fixture returned to Sta. 1, all welding would be completed.

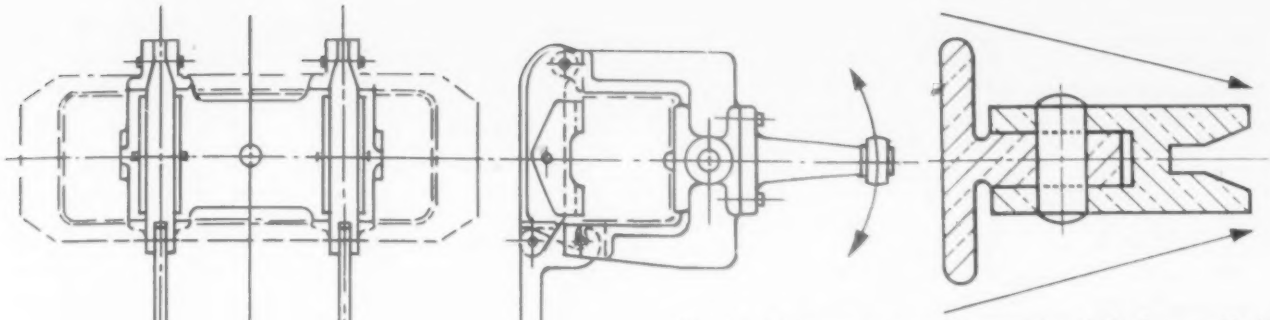
The loader would then remove the completed assembly and return it to the conveyor, but at the left of the station. He would then swing on his heel—really an easy motion—and pick up a new trough and repeat.

In the meanwhile, each welder had only to weld two spots—one fillet weld on a vertical line, and one on the horizontal. As will be seen by the plan view, Fig. 2, there are exactly sixteen welds, or two for each of the eight welders who, incidentally, are disposed in staggered arrangement inside and outside of the circular conveyor.

Construction of the fixtures is shown in Fig. 4-A. Note that the fixtures rock on trunnions, with the amount of

FIG. 3. The "merry-go-round," consisting of a ring running on a circular track. The work moves to the machine and away from it, on a single belt conveyor, with one operator loading and unloading. Eight welders, disposed in staggered position inside and outside of the conveyor, produce at the rate of 240 completed assemblies per hour. AA is a section through the rotor and circular track, also, the section shows the slot at the cam crossover. BB is a similar section, but with the fixture in place and tilted toward operator No. 8.





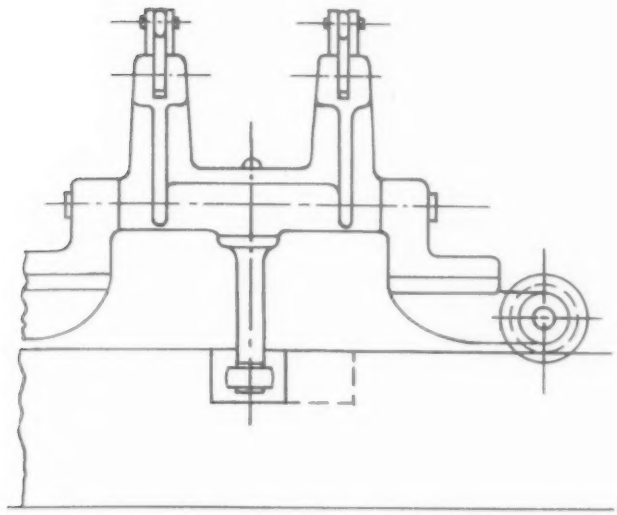


FIG. 4-A, left, shows the general construction of the fixture, with the weldment in place. The fixture rocks on a trunnion, and the degree of rock is determined by a continuous cam. Fixtures are identical and therefore interchangeable. FIG. 4-B, right, is a cross section through the clamp showing the Tee sections of the body and the lead-on of the clamping jaws.

rock—roughly 30°—controlled by a cam. As the fixtures approach each station they tilt so that the work is presented to the welder in an advantageous position. The fixtures straighten out as they approach the loading station, although even here a slight forward tilt facilitates loading and unloading.

So much for *modus operandi*. With regard to the machine itself, it was comparatively simple both in design and construction. A ring, about 18 ft. in diameter (Fig. 5) of 1" x 8" steel was made up and mounted on legs, then levelled, grouted and bolted to the floor. Another ring (Fig. 6) made up of structural steel—angle and channel, as shown at section AA, Fig. 3—and tied with cross members and provided with wheels, served as the conveyor.

Drive was through a reduction gear—shown at lower right, Fig. 3—with the driving shaft vertical. A commercial pintle chain served as a belt. Sprocket teeth were not provided, except on the driver, as some 50 ft. of wrap obviated all but a negligible slip. Takeup was by an idler on the driver.

The Problem of Tilt Solved

A fine problem was to tilt the fixtures from station to station—a matter of but a few feet—since the stationary ring interfered with the rocker arm. This problem was solved by providing a cam raceway, made up of two parallel strips of flat stock, and aligning this with slots flame cut in the stationary ring, partway down. See Section AA and BB, Fig. 3.

It may be inferred that the gaps, where the cam race crossed the ring, would cause bumping of the fixtures as the wheels passed over. However, each of the cross members joining the outer and inner ring of the conveyor were provided with a double flanged wheel and these not only kept the conveyor "on the track" but, with 18 wheels and only 9 gaps, there were always 9 wheels, at least, on the track at all times. Hence, no bumps. Spherical McGill ball bearing cam rollers (shown at extreme right, Fig. 4) easily followed the convolutions of the cam path and gave excellent service.

Another problem was to provide clamps that would not only insure exact location of the reenforcements and easy manipulation, but which would present a minimum of interference to the welders. The bodies of the clamps were therefore made T-section, as shown in Fig. 4-B. A rocker jaw, slotted to the thickness of the reenforcements, and provided with a beveled lead-on, not only aligned the reenforcements in the correct location but, because of the rocking feature, equalized pressure and pressed them solidly against the bottom of the trough.

The bodies were made of cast manganese bronze, while the rockers were of hard Ampco. The cam locks were of steel, hardened. One reason in choosing bronze for the bodies and jaws, was to reduce magnetic disturbances, and another was to reduce weld spatter. The latter, however, could not be entirely eliminated, although General Electric Company has recently introduced a compound that materially reduces, if it does not entirely eliminate such adherence of spatter.

More Production with Less Work

As previously, the output was at the rate of 4 finished assemblies per minute, or 240 per hour. This means that 15 seconds would elapse, in travel, from station to station. It does not, however, imply that each operator had 15 seconds in which to perform his stint. He had only a few seconds and, in that interval, merely welded two spots. This was the case for each of the eight welders.

With a total of 9 fixtures—one for each welder and one for the loader—the merry-go-round traveled at the rate of 2¼ minutes per revolution, or one welded assembly discharged every 15 seconds. In that interval, too, the loader had to unclamp and unload an assembly, place it on the outgoing conveyor, pick up a trough and set that in the fixture, position the reenforcements and clamp them. He was busy!

In view of the speed—and by now, it will be seen that it was fast—the reader may wonder if there wasn't some resistance, by labor, to its installation and use. There was. But, the operators were asked to suspend judgment pending a fair trial, and it can be reported that, at the end of the first day's run, the entire crew was sold on its merits.

Where, previously, the men had to exert themselves in lifting, loading, clamping, tilting and other toilsome and time consuming extras—all of which consumed the greater part of the time with only a minimum left for useful work—they now sat comfortably.

As one operator put it: "I just sit still, pass the electrode over the joint—bzzz, bzzz, bzzz—and let the rest of the world go by."

Even the loader was happy. "Sure, it keeps me humping," he admitted. "But then, the motion is so easy—just rocking on my heels—that it's more like dancing than work."

Right here is high-lighted one of the most important points in present day design of fixtures. That is, if tools are designed for operator convenience, there will be comparatively little resistance to cost saving innovations. Make the machine and its incidental fixtures do the work, and you will get production.

Well, the two case studies shown—the box assembly discussed in the previous installment and the cross member here described—can be amplified to "cover the waterfront." They were chosen to convey ideas, and it is to be hoped that they have served that purpose. It should be pointed out, however, that a merry-go-round of the type shown will run into considerable money. It may also be added, as an item of interest, that once constructed and installed it should not only return its cost, but pay an excellent return on investment in a very short time.

Of course, the merry-go-round is not presented as something entirely new or novel. The principle has been used for years, especially in rubber mills making tires and similar products. But, the conventional merry-go-round is usually made up as a wheel, with a central hub, not as a circular conveyor where the operators may work both outside and inside of the ring.

No Idle Fixtures or Stations

As shown here, the economy lies in the fact that there are no idle fixtures or stations, unless we consider the loader as non-productive. Output is speeded, not because the welders have to work hard, but because each has only one thing to do—strike an arc, repetitiously, in the same place, with the work advantageously tilted for easy accessibility. And, since the work moves to the machine and away from it, on the same conveyor, we have straight line flow to all practical purposes.

It is not implied, however, that straight line flow—with or without deviations—is the answer to most production problems. Where it can be applied, however, it effects marked economies in space and manufacturing costs. However, new techniques and appliances are constantly being presented, and the wise Tool Engineer will be alert to such innovations.

For instance, automatic welding heads and machines have now been developed to a point where they practically think, and recent recourse to electronics brings control to a nicety of precision heretofore unattained. Take, for example, automobile frames with their bends, kickups and box sections. With all their convolutions, they can now be laid on comparatively simple fixtures, clamped down, and continuous or skip welded from end to end with practically no more effort than pressing a push button. And that goes for many other intricate assemblies.

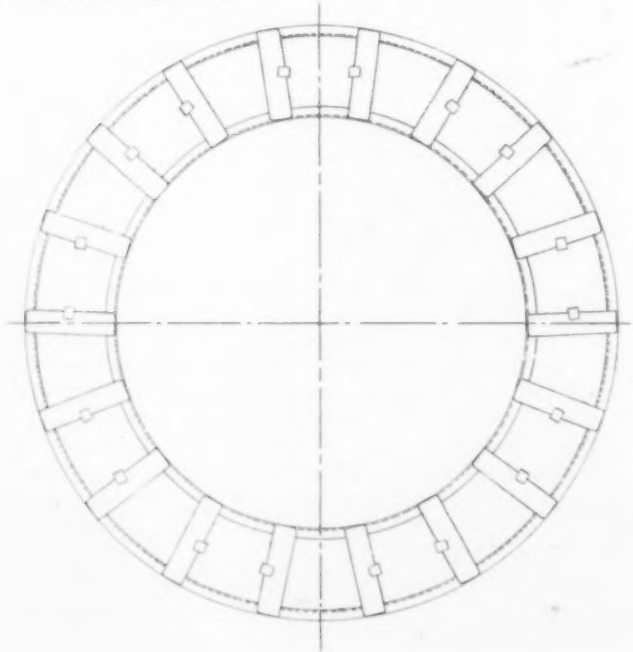
Until recently, automatic welding of intricate contours was rendered somewhat difficult because the rate of travel of the welding heads could not be closely controlled with conventional, constant speed motors. While the carriage travel might remain constant, the arc would lag or speed up, depending on whether the carriage turned an outside or inside corner. Now, thanks to the recently developed variable speed motor, the rate of travel can be exactly predetermined and held constant regardless of convolutions.

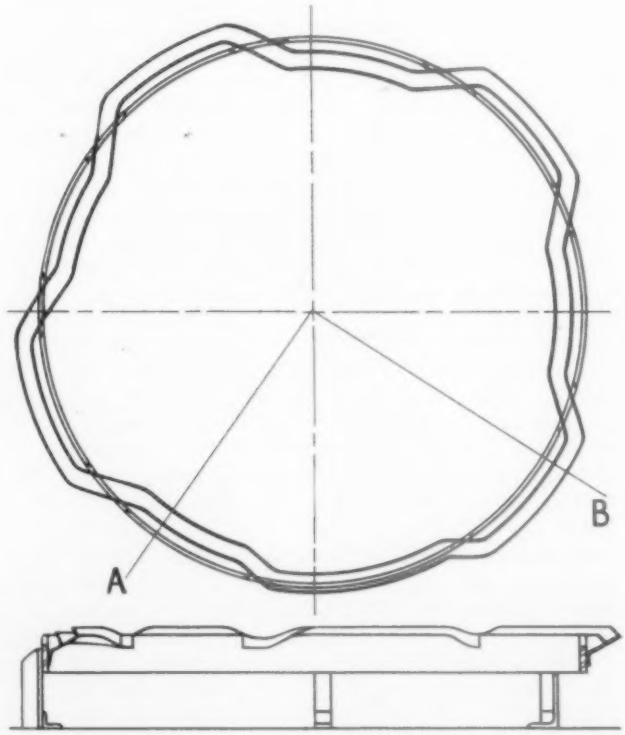
In conclusion, the writer wishes to impress two thoughts on the minds of his readers. One, that companies making welding equipment will extend to the prospective user every possible cooperation toward the solution of welding problems. These concerns are continually developing new equipment and techniques to serve an ever-broadening field. The modern Tool Engineer will keep abreast of these developments through new equipment releases—or "Tools of Today" as we term them in *The Tool Engineer*—which are published from time to time in the leading technical publications.

The second thought is that war developed techniques, in welding, will not go the way of surplus war material—that is, to have served only for the duration. Rather, they will be improved and expanded upon to provide more and better goods for peacetime use—and, it may be added: as moral persuasion for the preservation of peace. Technology goes on.

FIG. 5, at right, the circular track, which is made up of flat steel and provided with legs which, in turn, are bolted to the floor.

FIG. 6, below, the rotor, made up of an outer and inner ring made from structural steel. The cross members are steel castings, provided with double flanged wheels.





By A. O. Schmidt

Fundamentals and Applications of Carbide Milling*

Tool Life and Rate of Production Increased by Choosing The Correct Speed Rather than the Highest Recommended

A MACHINE TOOL is the inverse of a heat engine. While heat in some form is transformed into mechanical power in a heat engine, a machine tool is supplied with mechanical power which generates heat. A machining operation removes metal and thereby produces the desired result. As this cutting action becomes more efficient, less heat is generated in the chips, workpiece and tool. Minimum heat generation, therefore, is synonomous with minimum power consumption.

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Marked increases in production have been achieved as a result of improved cutting tool materials, tool design, higher operating feeds and speeds, workpieces designed and heat treated to facilitate machining, as well as increased rigidity and power in machine tools. Since the technique of machining steel with cemented carbides has advanced rapidly, it is not surprising, therefore, that contradictory theories concerning this technique are frequently advanced from various quarters. To many, in the field, phenomenal cutting speeds seem to be the ultimate answer to the problem of the most efficient method of machining steel. Results of numerous careful investigations, however, do not indicate that extremely high speeds, in excess of 1000 fpm, will be advantageous. (1)**

Applicable to All Metal Cutting

The first law of thermodynamics can be applied to any metal cutting operation: "When work is transformed into heat, or heat into work, the quantity of work is the mechanical equivalent of the quantity of heat." In machining operations, the calorimetric method has been used to determine power consumption at the tool. In a recent study of the forces in a drilling operation (2), a calorimeter was mounted on a dynamometer, see Fig. 1. Power values obtained from this setup, with either device, were in close agreement, within 1 to 3 per cent. Various metals were machined at different feeds and speeds. Since the individual tests were of only a few seconds duration, no corrections for heat losses were made because they did not influence results to any appreciable degree.

In computing the change of heat in the calorimeter the following formula can be used:

$$dQ = W c_m dT$$

where dQ = change of heat in the calorimeter
W = weight of calorimeter
c_m = mean specific heat of calorimeter
dT = change of temperature

The quantity of heat which the body, W, absorbs when heated from room temperature to a higher temperature is

$$Q = W \int_{T}^{T_n} c_m \, dT$$

where T_n = final calorimeter temperature
T = initial calorimeter temperature

Since the mean specific heat, c_m, can be considered constant in this case and all parts of the calorimeter as having obtained the same temperature,

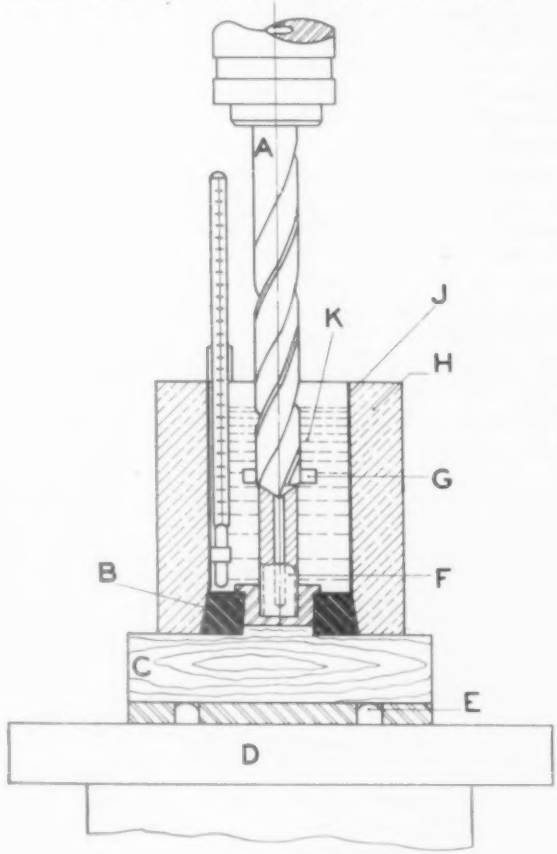
$$Q = W c_m (T_n - T)$$

In investigating radial rake angles in high-speed milling, a special calorimetric apparatus has been developed which

**This paper was originally scheduled for presentation at the A.S.T.E. 1946 Semi-Annual Meeting, Pittsburgh, Pennsylvania.*

***Numbers in parentheses refer to Bibliography at end of article.*

FIG. 1. Calorimetric apparatus for drilling tests mounted on a dynamometer for registering torque and thrust simultaneously.
A, drill; B, rubber grommet; C, woodblock; D, dynamometer for torque and thrust; E, centering pins; F, test bar; G, blades on drill for agitation; H, felt insulation; J, container; and K, water (50 cc).



permits determination of the relationships between cutting speeds, feeds, tool angles, and workpiece materials (3). The power required by the tool can be measured by determining the amount of heat in the chips with the calorimeter. There is no more reliable indication of the actual power consumption since most of the heat generated in a metal cutting operation originates in the chips. Tests conducted for over three years produced very consistent results which could be duplicated at any time. Discrepancies caused by varying efficiency of the machine tool drive motor and lubrication and friction factors in gears and bearings are eliminated. The calorimeter also has advantages over a dynamometer in that no delicate or complicated details are involved, and the apparatus itself is not affected by vibration at high cutting speeds.

A quantity of distilled water is employed as the medium for measuring the amount of heat generated by a combination of metallic friction and deformation during the cutting operations which are run without cutting fluids. The change of temperature of the water into which the chips fall is measured with a thermometer. To obtain correct chip temperature and power values, the water equivalent of the calorimeter and chips are determined. Cutting time for each test is as short as possible in order to minimize the heat losses. At the start of a test, water and equipment are held constant at room temperature.

Fig. 2 is a graphical representation of test results. Two-bladed cutters used in the test were run on a Kearney & Trecker 2K Vertical milling machine (4). Cutters, 3″ in diameter, were tested, each with different radial rake angles, including 30, 15, 6 deg. positive, 0 deg., and 6, 12, 20, 30 deg. negative. Test bars of SAE-1055 steel, Bhn 205, and 1 in. diam. were held in a three-jaw chuck which was secured to the table so that its centerline coincided with that of the cutter in the direction of table travel.

Tool Forces and Temperatures

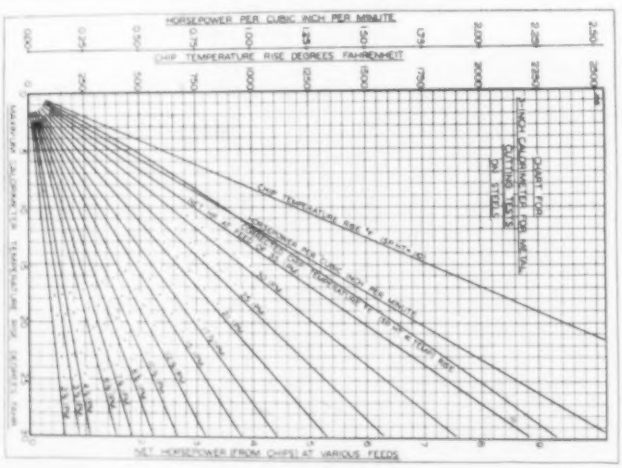
From the net horsepower of the cutter, as determined by the calorimeter, the tool forces were computed for the different rake angles with the formula

$hp = (F \times V)/33{,}000$

$F = (hp \times 33{,}000)/V$ where V = cutting speed in feet per minute.

This force, F, is the resultant of several component forces and it can be seen in Fig. 3 that F increases with the negative radial rake angle and decreases with the positive radial rake angle. It also shows how much the tool forces on a cutter with 12 deg. negative primary radial rake angle are reduced by the application of a positive secondary radial rake angle of 15 or 30 degrees. See Fig. 4.

FIG. 2. Graphical representation of calorimetric cutting tests.


HORSEPOWER PER CUBIC INCH PER MINUTE
CHIP TEMPERATURE RISE DEGREES FAHRENHEIT
NET HORSEPOWER FROM CHIPS AT VARIOUS FEEDS

It was found that the cutting force for a particular radial rake angle and chip cross section has substantially the same value at any cutting speed.

At a cutting speed of 300 fpm, the tool forces were not different from those at 600 or 1200 fpm. Since the maximum volume of metal removed with any test cutter was 0.3 cu in. per cutting tip, the cutters could be considered sharp throughout the test run. Therefore, any error introduced by a change in the cutting edge could be disregarded entirely.

Heat Per Unit Remains Constant

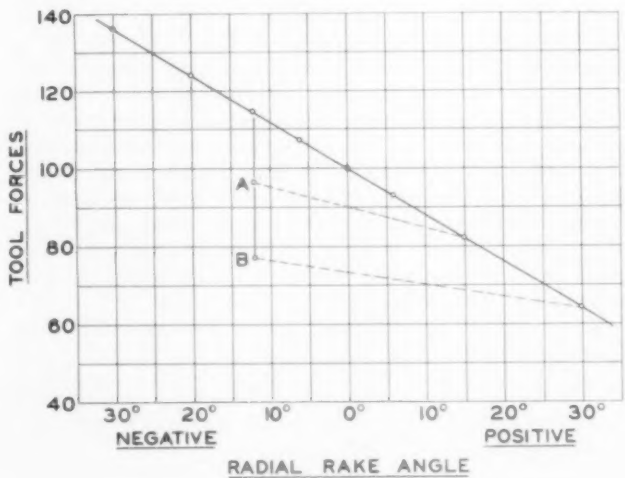
However, when cutting at 600 fpm, twice as much metal is removed per unit time as at 300 fpm and, consequently, the power required for cutting is doubled. In computing the chip temperature, the same value was obtained for both cutting speeds, see Fig. 5. Although twice as much work was done per unit time when cutting at a speed of 600 fpm as compared with 300 fpm, the temperature of the chips remained the same because the work was done in removing twice the amount of metal. This means there is twice as much chip material to carry away twice as much heat. (The amount of heat per unit weight of chips remains constant.)

Even though heat producing work must inevitably be done in metal cutting, it is possible to remove metal at extremely low speeds with a relatively low temperature rise in the chip (5). This is possible because the chip is separated slowly, and the heat in the chip is given a chance to flow into the tool and the workpiece. At higher speeds the amount of work done is proportional to the increased cutting speed, and most of the heat developed is carried away with the chip because of the short time the chip is in contact with the workpiece and tool.

The average chip temperature measured at higher cutting speeds is more uniform because there is less chance for the heat to travel into the tool and the workpiece. As soon as the temperature at the cutting edge corresponds to that in the chip, there is no further heat flow from the chip into the tool. The greater amount of work which is done per unit-time at higher cutting speeds and the resulting greater amount of heat is carried by a correspondingly larger weight of chips.

When the cutting speed is increased, the tool does a proportionately greater amount of work. This results in a temperature increase in the tool material. The heat will not be uniform in the tool, but most intense near the point at which the cutting takes place. Consequently the zone near the cutting edge will reach the highest temperature and break down first.

FIG. 3. Tool forces in relation to radial rake angles on a milling cutter. Forces on 0° rake cutter taken as 100. Points indicated (at A and B) represent relative tool forces on cutters which had a negative primary radial rake angle of 12 deg. and a positive secondary radial rake angle of (A) 15 deg. or (B) 30 degrees.



The heat in the tool is of importance because it is the accumulation and concentration of intense heat at the cutting edge of the tool which hastens failure. Comparing tool life with cutting speed, as brought out in many reports (6), it is evident that the amount of metal removed before tool failure will generally be inversely proportional to the cutting speed when the chip cross section is kept constant. This happens despite the fact that the chip temperature will remain substantially the same.

Higher Speeds, Faster Breakdown

Assuming an ideal case in which the tool does not wear and thus change the cutting forces, the same volume of the tool tip itself has to dissipate twice the amount of heat per unit time when the cutting speed is doubled, and can do this only by increasing its temperature. For this reason, a tool will break down faster at higher cutting speeds, and remove a smaller volume of metal than at a lower cutting speed. There is only a small zone, including the cutting edge of the tool, which will have a high heat increase with an increase in cutting speed. It is in this zone that most of the friction between the chip and the tool occurs.

High cutting speeds, from 1000 to 3500 sfpm, have been reported and frequently recommended for steel milling operations. Behind these recommendations is the belief that definite advantages can be realized from extremely high cutting speeds.

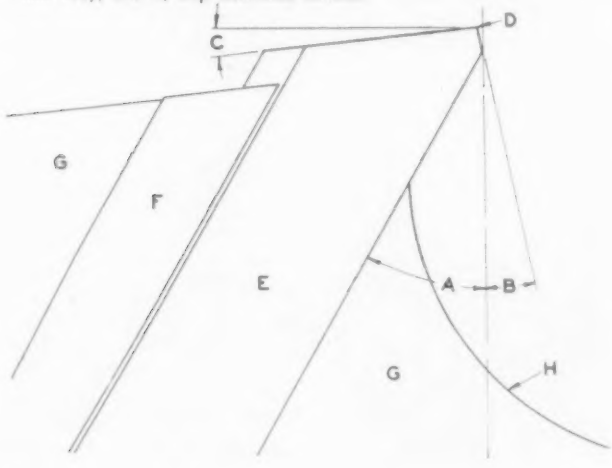
To ascertain the effect of cutting speed upon the cemented carbide cutting edge another series of milling tests was made at speeds from 130 to 3280 fpm with the same feed per tooth maintained at each speed (1). The results showed that the friction between the chip and the blade face and the heat generated by the friction—both of which are concentrated in the zone immediately around the cutting edge—cause a greater degree of tool wear at high cutting speeds than at low speeds, with the same volume of metal being removed at each speed.

In these steel milling experiments, which were conducted with the calorimetric test equipment, the surface temperature of the workpiece was measured before and after each cut with an Alnor low range thermocouple.

Of course, the temperature of the workpiece is affected chiefly by its size, heat conductivity, and specific heat. Other factors which also influence the workpiece temperature include cutting speed, cross section of chips, tool design, and wear at the cutting edge. All these must be taken into consideration.

FIG. 4. Schematic diagram of milling cutter tooth with 12 deg. negative primary radial rake and positive secondary radial rake angle.

A, positive secondary radial rake angle; B, negative primary radial rake angle; C, peripheral clearance angle; D, cutting edge; E, inserted solid cemented carbide blade; F, hardened wedge; G, face mill body; and H, chip clearance surface.



However, if all conditions except cutting speed are kept constant, the following can be stated with regard to the chips, tool, and workpiece: The temperature of chips of uniform cross section remains approximately the same in the high range of cutting speeds; the temperature at the cutting edge of a tool increases with time and cutting speed; and, the temperature of the workpiece is lower at the higher cutting speeds.

From the calorimetric power analysis and cutter life tests the following points in particular have been established:

Power required at the cutting edge is higher from the negative radial rake angle cutters than for cutters with positive radial rake angles. This holds true for conventional cutting speeds as well as for higher cutting speeds up to 1180 fpm.

Negative Rake Tools Last Longer

Cutters with negative radial rake angles will stand up longer when cutting steel than positive radial rake angle cutters under identical conditions.

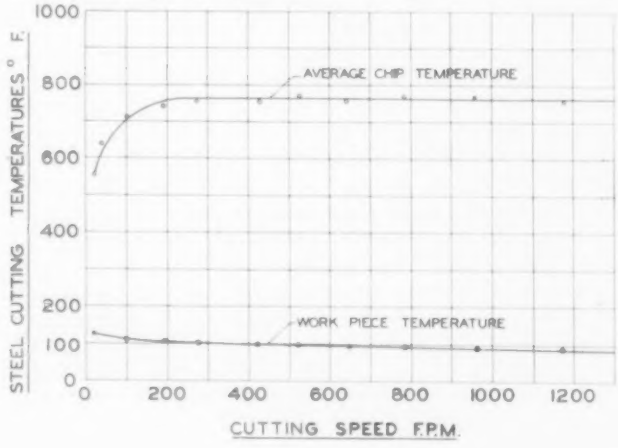
At high speeds, wear and failure at the cutting edge of a positive radial rake angle cutter will soon increase its power consumption above that of a cutter with negative radial rake angles.

A cutter with a 15 deg. positive secondary radial rake angle, with a negative primary radial rake angle at the cutting edge 1 to 2 times the width of feed per tooth, was found to be most effective since it combined the increased strength of the cutting edge afforded by negative radial rake angles with the lower power requirement of the cutter with positive radial rake angles.

Fig. 6 shows a face milling cutter which is designed according to the principles determined by the calorimetric studies. The solid cemented carbide blades are set at a 15 deg. positive radial rake angle and are provided with a negative radial rake face 0.020" wide at the peripheral cutting edge. The wedge which holds the cutting blade in place is located behind the blade in order to provide uninterrupted chip accommodation space and guide the chip after it has been separated from the workpiece. The blades can easily be exchanged or reset when necessary and in regrinding the cutter very little carbide material has to be removed. The arrangement of the two radial rake angles on the same tooth will permit simple and complete removal of all wear marks by regrinding.

This milling cutter has been tried first in long run production tests on aircraft parts made of high strength alloy

FIG. 5. Average temperature of steel workpiece and chips in relation to cutting speed. (Feed per tooth, 0.008"; depth of cut, 0.125". Cutter with 6 deg. negative radial rake angle.) Chip temperatures measured with a calorimeter; and surface temperatures of workpiece determined by Alnor low range thermocouple.



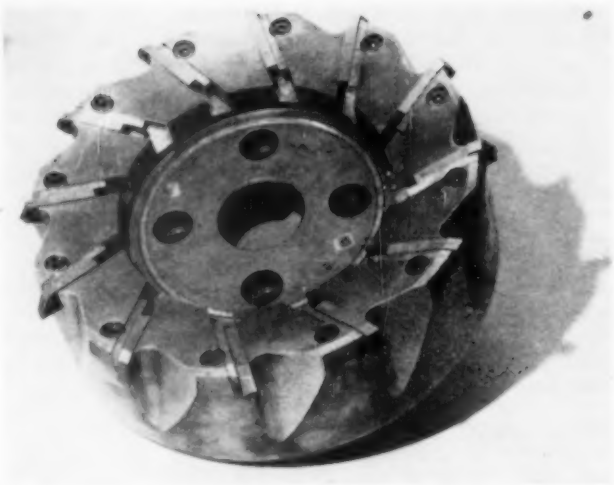


FIG. 6. Milling cutter 10 in. diam. with 12 inserted blades at 15 deg. positive secondary radial rake angle, with negative primary radial rake angle at cutting edge. By grinding different radial rake angles, see B in Fig. 4, at the cutting edge, the same cutter can be used on other materials—e.g., aluminum, cast iron, and nickel alloys.

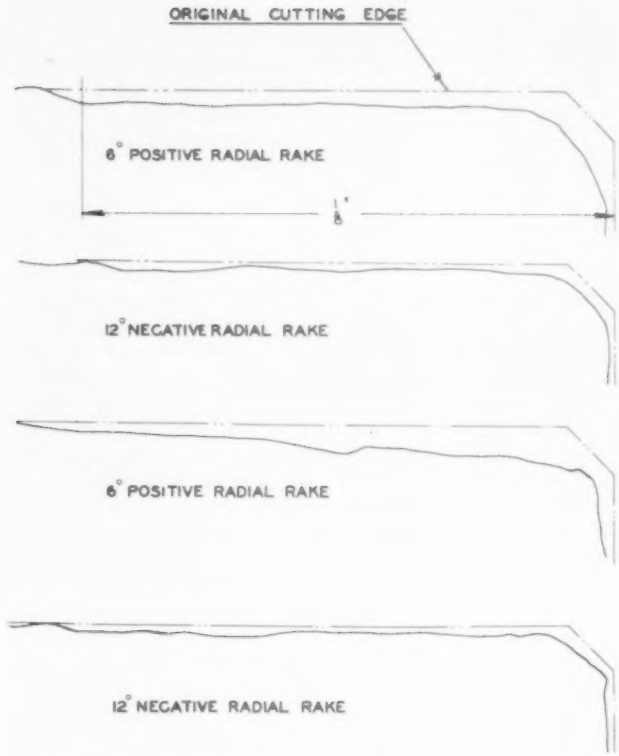


FIG. 7, right. Optical comparator silhouettes of the cutting edge of 6 deg. positive and 12 deg. negative radial rake angles. Upper silhouettes are of cutters whose blades were not chromium plated, lower ones were chromium plated. Cuttting speed, 523 fpm; feed, 15 ipm; depth of cut, 0.125". Each tip has machined 21 cu. in. of steel SAE-1020, Bhn 180.

steels and has proven superior in the number of workpieces per grind. It cut at feeds and depths of cut which stalled the same milling machine when ordinary negative rake angle cutters were used. The lighter temper color, shape, and deformation of the chips, as well as lower wattmeter readings demonstrated a better cutting action which caused less pressure, vibration, and deflection in the workpiece and machine tool members. Calorimetric measurements confirmed that combined angle cutters require less power at the cutting edge than negative angle cutters under identical conditions.

Chrome Plating of Carbide Cutters

Chromium plating of tools is frequently recommended if, in a general way, even for carbide tips. During investigation of the radial rake angles in face milling cutters several thousands of tests were made with cutters identical except for the radial rake angle. For one series of tests the blades of these cutters were chromium plated by a firm specializing in this kind of work and then subjected to the same working conditions. The results of these tests indicated the same average tool life and performance as for cutters in which the blades were not chromium plated.

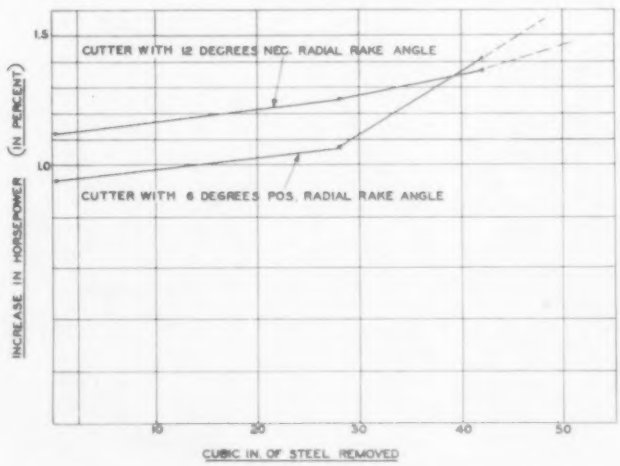
Twelve two-bladed cutters of two-inch diameter with chromium plated carbide tips of a steel cutting grade were used. The radial rake angles were either 6° positive or 12° negative. Tests included calorimetric power determinations in which each blade removed 0.3 cu. in. of SAE-1055 steel at a cutting speed of 785 fpm and a feed of 0.005" per tooth. It was observed that the power required was equal to that of cutters in which tips were not chromium plated.

The cutters were then subjected to a tool life test at the same speeds and feeds. Each cutter removed 42 cubic inches of SAE-1020. There was little difference between the wear of chromium plated and unplated tips (Fig. 7). It can be seen that the cutting edges with 12° negative radial rake angle had worn less, as could be expected. Power consumption tests of these worn cutters showed an increase of about 50 per cent for the one with 6° positive radial rake angles and 22 per cent for the one with 12° negative radial rake angles.

In Fig. 8 is plotted the increase in horsepower in relation to the amount of metal removed in these tests. Although the positive radial rake angle cutter used less power at the beginning of the test when sharp, after cutting 28 cu. in. of steel its power consumption increased more quickly due to rapid wear at the cutting edge. Subsequent to machining 42 cu. in., the positive radial rake angle cutter required more power than the 12 deg. negative radial rake angle cutter which had worn less and more evenly. This relationship held true for plated and unplated cutters. When identical chromium plated and unplated cutters were tested at 523 fpm cutting speed and 0.0075 in. feed per tooth similar observations were made.

From these tests it was concluded that chromium plating the carbide tips would not improve a cutter when used for cutting steel at high cutting speeds. This is also in agreement with observations of the general temperature distribution in a metal cutting operation. The temperature at the

FIG. 8. Increase in power consumption of 2-bladed cutter in relation to metal removal. Upper curve for cutter with 12 deg. negative radial rake angles. Lower curve for cutter with 6 deg. positive radial rake angles.



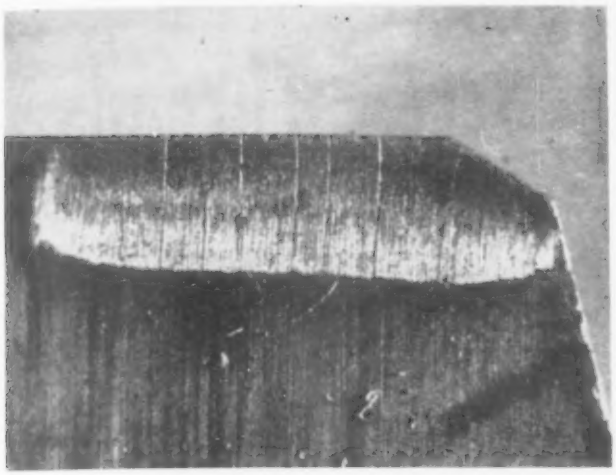
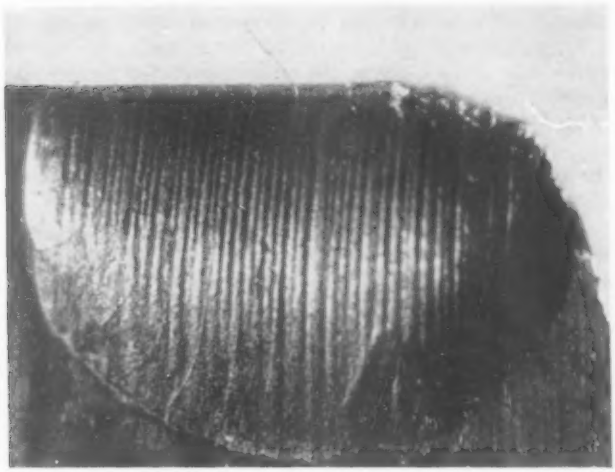


FIG. 9. Cemented carbide cutting tools after machining 10.8 cu. in. of steel. Depth of cut, 0.150"; feed, 0.010" per tooth. Top, cutting speed 580 fpm; bottom, cutting speed 2650 fpm. (Depth of cratering 0.050".)



cutting edge of a tool increases with the cutting speed and the time of cutting. This leads to rapid wear and even disintegration of the cutting edge when milling steel at a cutting speed above 800 fpm. See Fig. 9.

When measuring the hardness of chromium layers on tools made of high-speed and carbon steel, Schallbroch and Hielscher (7) found that the values of 750 to 800 Brinell at room temperature decreased to approximately one-half to two-thirds of these figures at a temperature of 750° F. They

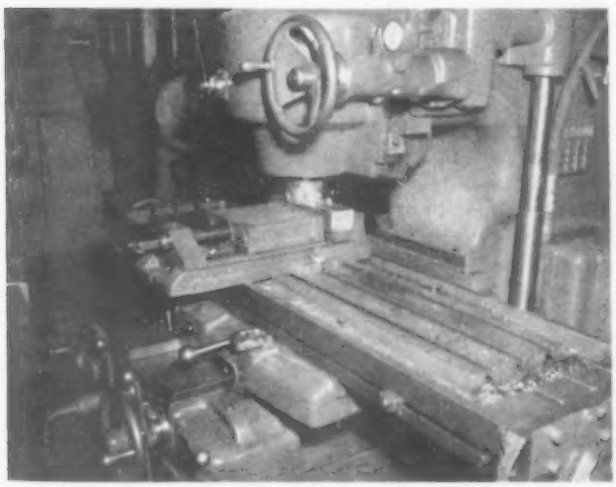


FIG. 10. Face mill, 4" dia., with chromium plated flutes.

recommend that chromium plated tips should not be operated at tool temperatures in excess of 570° to 660° F., and generally should not be used for cutting cast iron and steel, since much higher temperatures will be encountered at the cutting edge of tools machining these materials.

However, they also report increases in the life of high-speed steel lathe tools from 2 to 11 times when cutting zinc, aluminum alloys, or plastics. With the application of coolants an even greater improvement is obtained.

Importance of Chromium Plating

Although the direct application of chromium plating to cemented carbide cutter blades for milling steels at high speeds was found not to bring about any marked improvement, it is felt that chromium plating does have its important place. Fig. 10 shows a cutter with solid cemented carbide blades for milling steel. In this cutter the flute in front of the blade is chromium plated. It is here that the steel chips will impinge when coming off the tool tip.

Chips have often been observed to stick to a hardened cutter body, causing tip failure by getting between the tip and the workpiece. Chromium plating and polishing this part of the cutter body eliminated scoring and chip interference, and thus remarkably improved the performance of the milling cutters at high cutting speeds, giving longer tool life between regrinds even at very high rates of metal removal. See Fig. 11. Better finish on the workpiece was an additional benefit because the chips, being thrown clear of the cutter body, could not get trapped or jammed into the chip flutes and thus scratch or mar the machined surface.

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FIG. 11, left. Testing the cutter shown in Fig. 10 on 50 hp C S M machine. During this breakdown test the cutter was run at 680 fpm, with feeds ranging from 42 to 60 ipm. Workpiece material steel NE-8022, 200 Bhn, 3 in. wide, depth of cut 0.400". Chips came off very freely; and 280 cu. in. of metal were removed before cutter had to be resharpened. Wattmeter readings indicated 80 to 90 hp for some cuts—no slipping or breaking of carbide blades occurred.

By John Wesley Lee

Wire Dimensions for Screw Threads

Indirect and Direct Measurements Reconciled By the Method of Calculating the Relativity

THE PRIMARY OBJECT of this treatise is to present data and formulae necessary to calculate authentic wire dimensions for screw threads, which must necessarily take into consideration the effect caused by the helix angle. But is not intended to alter the established procedure of measuring standard screw threads whose helix angles are all less than five degrees.

It is written especially for the benefit of the Tool Engineer who seldom has an occasion to calculate wire dimensions for a special thread and is not familiar with or fully aware of the condition of such problems.

John Wesley Lee **is an "old timer" in tool engineering, having started practical training, supplemented with I.C.S. courses in design and engineering, in 1909. After several years as tool designer in Detroit plants, he moved to Dayton, Ohio where, during World War I, he was special machine designer at the Naval Ordnance plant.**

Later, he held executive positions in engineering and production, at City Machine & Tool Co. (now Sheffield Corp'n); Inland Mfg Co.; Delco Div'n, G.M.C.; and, from 1933 to '45, with Inland Div'n, G.M.C., where he served as consulting engineer during World War II. He is owner of the R. G. Lee Tool Co., Dayton, and a member of Dayton Chapter, A.S.T.E.

The three-wire system has been found to be the most accurate and satisfactory method of measuring the pitch diameter of screw threads. Its universal use for measuring thread plug gages has been approved by the National Bureau of Standards. However, where any indirect method of measuring, such as the wire method for screw threads and gear teeth, or the sine bar method for angles and tapers is used, in which the relativity between the given dimension and the direct measurement depends upon a mathematical computation, the results can be no more accurate than the method of calculating the relativity.

The American National Form Thread is a continuous ridge of uniform cross section, in the form of a helix around the surface of a cylinder, the axial cross section of which is a true Vee, with flats at the crest and root, the sides of which are formed by straight lines at an angle of thirty degrees with a line perpendicular to the axis of the cylinder.

In conformity with National Standard practice, the width, depth, and angle of all threads are specified as of the axial section; however, at a normal section where the wire method of measuring must be applied, those dimensions are somewhat distorted due to the helix angle.

In the conventional method of calculating wire dimensions for screw threads, as outlined in all handbooks, including the National Bureau of Standards' Handbook H-28, it is assumed that the measuring wires lie perpendicular to the axis of the screw and contact the sides of the thread at the pitch diameter on the axial section.

It is obvious, however, that it is impossible for a cylindrical wire to make contacts with the sides of a thread at an axial section; instead, when a wire is laid in a thread groove, it will make contacts at the normal section and will lie parallel with the helix at the points of contact.

There are four major differences between the size and shape at a normal section and the size and shape at an axial section of a thread groove, which effects the calculation of authentic wire dimensions. And, when the thread helix angle is over five degrees, these differences should be taken into consideration.

The sides of a thread are slightly curved at the normal section, and straight at the axial section. The slope of the curve at the pitch diameter, at the normal section, is slightly less than the slant of the straight side at the axial section. The width of the space at the pitch diameter at the normal section is considerably less than one-half the pitch, or width of space at the axial section. And the distance from the center of the screw to the normal chord is less than one-half the pitch diameter, or the distance from the center to the axial chord.

When a measuring wire of the correct diameter is placed in the groove between two threads it will contact the threads at the pitch diameter and will lie parallel with the thread helix. Or, in other words, it will make contacts at points N_1 and N_3, Fig. 3.

Since there is no way of determining the location of the points at which a given diameter wire will make contacts, or no way of calculating the slope of the curve at the points of contact, it is impossible to calculate authentic wire dimensions for screw threads in terms of a given diameter of measuring wire.

Since the size and shape of the normal cross section of a thread is determined by the thread helix angle, it is relatively easy to calculate the width of the space and the slope of the curve on the sides of the thread, on the normal section, at any position between the root and crest of the thread; also, to calculate the diameter of wires that will make contacts at these points; and, dimensions over these wires.

It would appear that this procedure would require a different diameter measuring wire for each and every different screw thread; however, this is not the case. While the sides of a thread at the normal section are slightly curved, it is obvious that the difference between the slope at the pitch diameter and the slope at a point a few thousandths of an inch above the pitch diameter is infinitesimal and may be disregarded.

Therefore, after the correct size wires, and the dimension over the wires has been calculated for any given thread, it is permissible to assume that the slope remains constant, and to calculate relative dimensions over slightly larger size wires.

The drawings will serve as a means of representing the various elements of the screw thread and will facilitate the concept of the formulae necessary for calculating accurate wire dimensions.

Since the object of this discussion is to show the effect that the thread helix angle has on the shape and size of the thread at a normal section, and also how it effects the calculation of authentic wire dimension, it was deemed

advisable to choose a small diameter, coarse pitch, triple-thread screw which would have a relatively large helix angle.

Fig. 1 is a side elevation and end view of a triple thread screw. The two dotted right hand helix at the central portion represent the two thread helix at the pitch diameter. The left hand helix represents the normal helix at the pitch diameter.

P is the pitch of the thread.
L is the lead of the thread.
PR is the pitch radius.
α is the thread helix angle.
AA is the axial section.
NN is the normal section.

Fig. 2 shows an axial and a normal cross section of the thread in the axial section—the sides or flanks of the thread are straight lines. In the normal section the flanks of the thread are slightly curved, and the slope of the curve at the pitch line is slightly less than the slant of the straight line in the axial section.

PR is the pitch radius.
Ca is one-half the axial chord.
θ is one-half the thread angle.
H is height of normal chord above center line of screw.
h is height from normal chord to center of correct measuring wire.
Cn is one-half the normal chord.
ϕ is the slope of the curve at the pitch line.
Rc is the radius of correct measuring wire.
Mc (see Fig. 4) is measurement over correct wires.

Fig. 3 shows a portion of a top view and end elevation of the pitch diameter, points N_1 and N_3 are the intersections of the normal helix and the two thread helix. The straight line N_1 to N_3 is the normal chord.

A_1A_3 is the axial chord.
N_1N_3 is the normal chord.
Ca is one-half the normal chord.
B_1B_3 is the projected normal chord.
S is one-half the projected chord.

FORMULAE

FIGURE 1

1. $\text{TAN } \alpha = \dfrac{\text{LEAD}}{PD\pi}$

2. $\text{SIN } \alpha = \dfrac{\text{TAN } \alpha}{\sqrt{1 + \text{TAN}^2 \alpha}}$

3. $\text{COS } \alpha = \dfrac{1}{\sqrt{1 + \text{TAN}^2 \alpha}}$

4. $\text{SIN } \alpha \text{ COS } \alpha = \dfrac{\text{TAN } \alpha}{1 + \text{TAN}^2 \alpha}$

FIGURE 2

9. $\text{TAN } \phi = \text{TAN } \theta \times \text{COS } \alpha$

10. $h = C_N \times \text{TAN } \phi$

11. $R_c = \sqrt{C_N^2 + h^2}$

12. $M_c = 2 \times (H + R + h)$

FIGURE 3

5. $C_A = \dfrac{P}{4}$

6. $C_N = C_A \times \text{COS } \alpha$

7. $S = C_A \times \text{SIN } \alpha \times \text{COS } \alpha$

8. $H = \sqrt{PR^2 - S^2}$

FIGURE 4

13. $V_c = \dfrac{R_c}{\text{SIN } \phi}$

14. $V_s = \dfrac{R_s}{\text{SIN } \phi}$

15. $X = R_s - R_c + V_s - V_c$

16. $M_s = M_c + 2X$

H is height of projected chord above center line of screw.
PR is radius of pitch circle.

Fig. 4 is a normal section of two thread groves, with a correct size wire in one grove; and a slightly larger, or the next size, standard size wire in the other grove. The reference line YZ is parallel with the centerline of the screw and passes through the vertex of an imaginary Vee whose one-half angle is equal to ϕ: the slope of the curve at the pitch line.

Mc is the measurement over correct size wires.
Rc is radius of correct size wire.
Rs is radius of standard wire.
Ms is the measurement over standard wires.
X is amount standard wire will extend over correct wire.

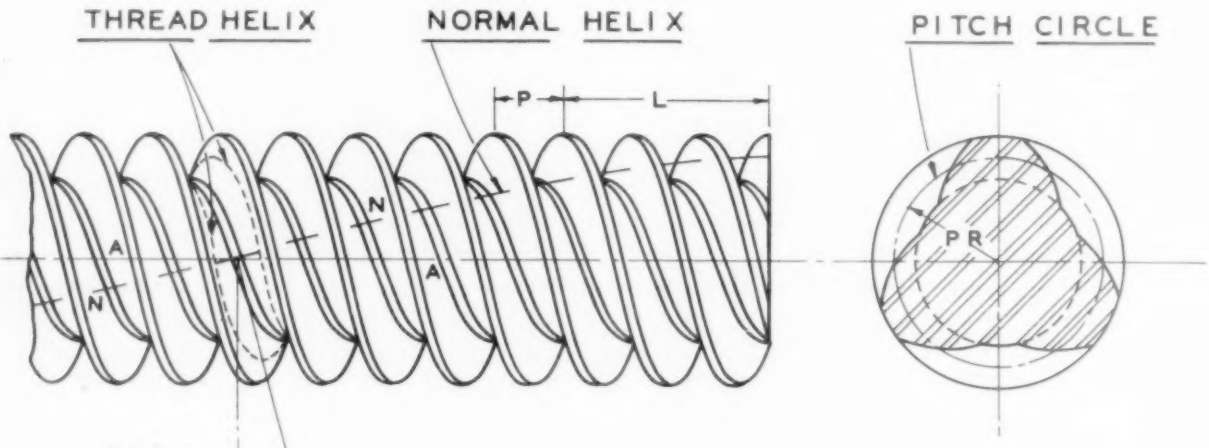


FIG. 1

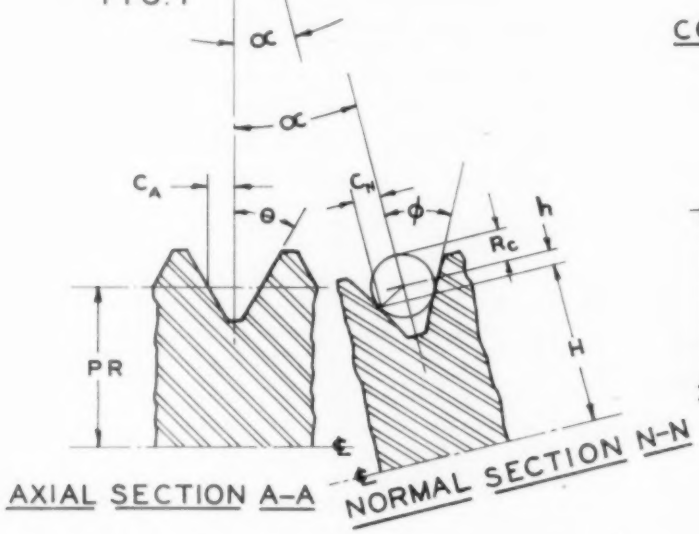


FIG. 2

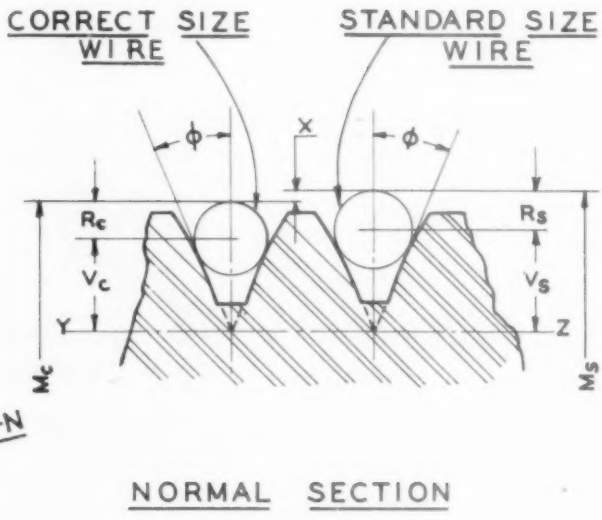


FIG. 4

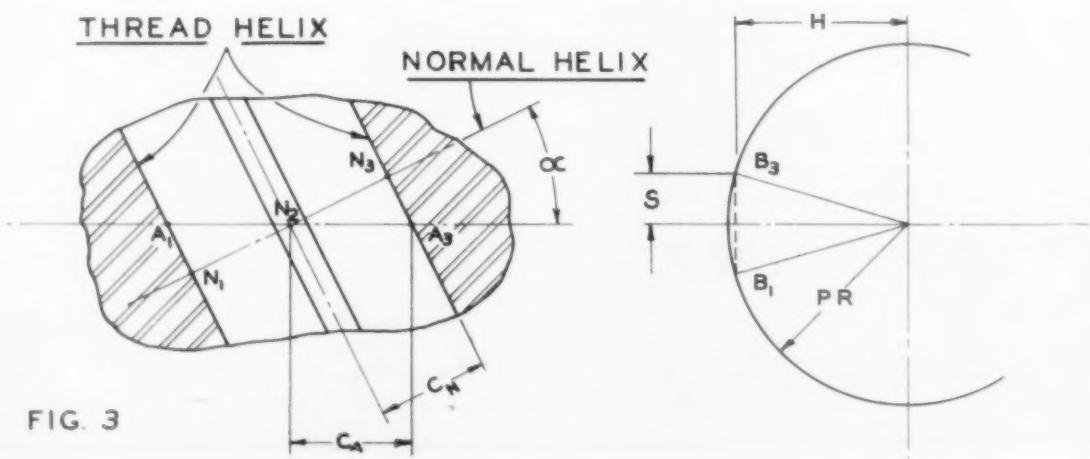


FIG. 3

By Carl A. Holmer

Repair Your Own Instruments—It Pays!

Delays Are Avoided and Repair Costs Reduced by Setting Up a Department for Servicing of Delicate Measuring Instruments

IF YOU ARE a factory manager, chief inspector, research supervisor, maintenance superintendent, the owner of a manufacturing plant, or a testing engineer who sends out instruments for cleaning and repair work, the chances are that this important job is one of your major headaches.

***Carl A. Holmer*, Toolroom Superintendent at Caterpillar Tractor Co., Peoria, Ill., was born in Sweden, where he learned machine work and toolmaking. He is a member of Peoria Chapter, A.S.T.E., which he has served as Vice Ch'man, and Chairman. He also served as an A.S.T.E. director, 1943 to '45, and is currently active on the Finance Committee.**

Vital production is held up while you wait for a repairman —over which you may have no control—to "get around" to your job. And no matter how small the repair job, the repair bill usually seems to be about as high as the traffic will bear; besides, hours and even days are lost because of an adjustment that can be made in a matter of minutes. These are just a few of the instrument repair worries of the plant that doesn't do its own work.

But, you may say, "That's a complicated job. We don't have anyone trained for this work, nor do we have enough volume to keep a man busy full time. Neither have we anyone capable of supervising such work, nor a department set up to handle it."

Valid objections, all of them, but if they actually exist in your plant, yours is the rare exception. Regardless of size, most shops can handle this type of repair by someone already on the payroll who is handy with small tools, and likes to "fiddle" around. And, if you follow the plan worked out at Caterpillar Tractor Company of Peoria, Illinois, you'll likely find the costs offset by the saving in time alone.

Do as we did, by setting this "handy man" mechanic up in business in a corner of the toolroom, where the superintendent can keep an eye on him and supervise the system to control the flow of work. It sounds easy, and actually is almost that easy.

This is a "request" article, in response to reader demand for information on instrument repairs. The Editors.

Proven by Trial

At "Caterpillar," such a central department has been successfully functioning for seven years. Prior to this time, instruments were either repaired throughout the plant by various craftsmen, or sent out. In this seven years, much has been learned about operating this kind of department efficiently; and here, jotted down at random, are a few helpful hints to anyone who is planning to organize such a setup.

1. An instrument repairman is a good mechanic trained for delicate work. A good horologist has this training. If you have one, use him. Very little additional training and experience is required to fit him for repair of shop instruments.

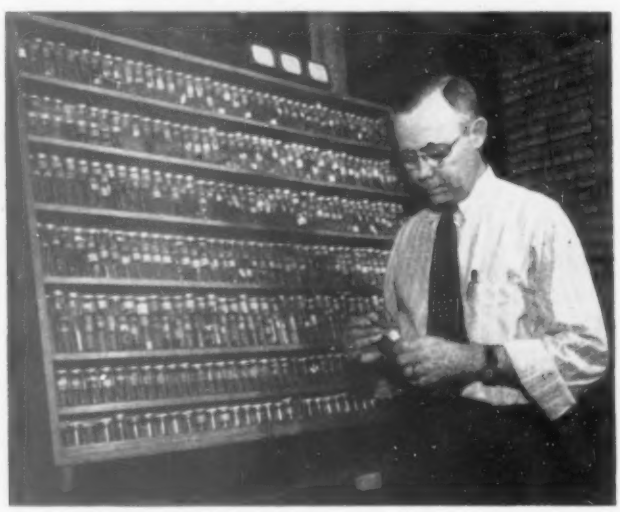
2. Equipment required is identical to that of a watchmaker. Also required are good lighting and adequate storage facilities for parts. An enclosed area, approximately 10 ft. x 12 ft., will house equipment and parts' storage facilities and provide sufficient work area for two men.

3. Be sure to enclose the area for the sake of the men, who must closely concentrate on their work.

4. Repair parts can be purchased for all standard makes of instruments, for parts and price lists are furnished by all vendors; however, a competent man can make many of the parts which, for one reason or another, may be unobtainable. Experience alone will determine what and how many of any given part to stock. Experience will also determine what parts can be economically salvaged.

A craftsman repairs a stop watch in the modern and efficient instrument repair department at Caterpillar Tractor Company. Note the watch repair tools used for this delicate work.

A complete parts' stock in a square yard of glass bottles attests the delicacy of work performed by the two craftsmen in the instrument repair shop at the Peoria plant of Caterpillar Tractor Company.



5. Control of the work, to and from the instrument repair department, is very important. A written record system, regularly checked, is essential.

6. Instruments should carry an identification number for record purposes.

Note that, under the "Caterpillar" system, when an instrument needs repair, a standard tool delivery tag (see Fig. 1) which has a carbon flyleaf, is filled out. The flyleaf is retained for the records of the department initiating the work, and the tag and instrument are sent to the toolroom office. The toolroom office then makes a record on a card, (see Fig. 2) showing the instrument, dates of receipt and delivery, and the number of times repaired. It also gives an indication as to use or abuse of the instrument.

7. Schedule regular trips with accumulated work between toolroom office, or other point where work is gathered, and the instrument repair department. This insures privacy for workers and permits maximum concentration on legitimate repair work.

8. Return finished work to the toolroom office or the original gathering point for pick-up by the departments initiating the repairs. Be sure to clear the records.

Form 7591

TOOL DELIVERY

Deliver To *Inst. Rep.*
Location *Bldg. II*
Px No.
Description # *1515 Indicator*
Remarks *Repair*

Date *12-15-46*
Return To *Research Crib*
Location *Bldg. W*
Signed *Beldi.*

FIG. 1, right. Standard tool delivery tag is filled out with carbon flyleaf duplicate. Tag and instrument to be repaired are then sent to the toolroom office, while the carbon flyleaf is retained by the department ordering the work.

9. The type of repairs required becomes more or less standardized. Disassembling, cleaning and reassembling is the most common type of repair needed. When an instrument is disassembled for cleaning, all or nearly all parts are exposed enough for a visual inspection to determine whether new parts or other work is needed.

10. It helps to keep a stock of common instruments in the repair department, indicators in particular. These can be ordered as needed from this stock, and a supply of checked and serviced instruments is always ready for immediate delivery.

11. The repairmen become acquainted with makes of instruments that frequently need repair and are therefore in a position to recommend correction in either choice of instrument or method of use. Heed their advice and save money!

So, if your plant uses tachometers, stop watches, indicators and gages in good volume—and what plant doesn't in these days of automatic machines and precision manufacturing?—it will pay you to check your costs and delays resulting from outside instrument repair. You will be surprised how quickly your repair bills will add up to a sum that will more than support your own instrument shop.

FIG. 2, below. The toolroom office uses this precision instrument record card, listing the instrument to be repaired, dates of receipt and delivery, and number of times repaired. Information relative to use and abuse of the instrument is also recorded on this record card.

PRECISION INSTRUMENT RECORD CARD

INST NO.

Card No.

USED ON

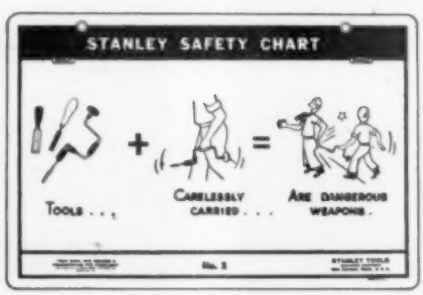
LOCATION

Date To Tool Room	Date To Shop	Signature	Date To Tool Room	Date To Shop	Signature

Stanley Safety Charts

To PROMOTE safety mindedness in industrial plants, and to stimulate interest in safety practices among plant employees, Stanley Tools has prepared a series of thirty-six Safety Charts, each of which gives one complete safety message.

One or two of the charts may be displayed on the safety bulletin board, or elsewhere in the plant each week; in this way, one set of the Charts can be used for several months or more without duplication.



The Stanley Safety Charts are offered to industrial plants at the cost of printing and postage, $2.50 per set anywhere in the U.S.A. (Canadian price is $4.10 per set, payable in Canadian funds.) Check for proper amount should be mailed with order to Stanley Tools, Educational Department, New Britain, Conn.

By Thomas A. Dickinson

Plasticarve—A New Tooling Plastic

Handformed Like Clay, but Possessed of Dimensional Stability, This New Plastic Material Effects Marked Economies in Tooling

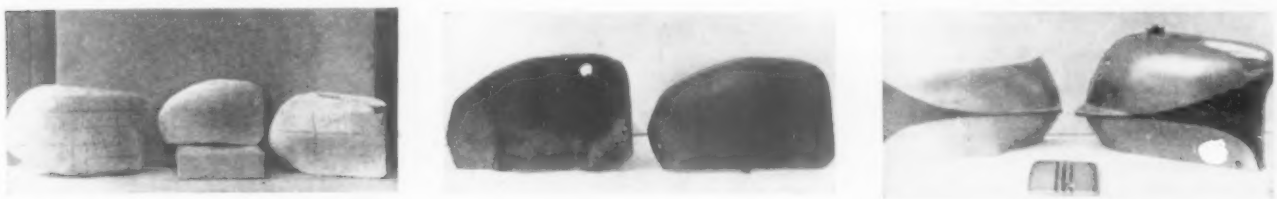
Mr. Dickinson

SHORTAGE OF "LOW-MELT" materials such as Cerrolow, Cerrobend, wax, and plaster compounds has resulted in the development of a new tooling plastic known as Plasticarve. It should be particularly suitable for the fabrication of models, mockups, or patterns because it can be handformed like water clay when it is heated to only 110° F.; and, as a matter of fact, it is already being extensively used for this purpose in the Los Angeles area.

In its natural form, and at temperatures of less than 100° F., it is a rather brittle milk-white material with glossy-translucent surfaces and good dimensional stability. When heated to a temperature of 110° F., as above suggested, it retains its natural appearance although it is pliable enough to be molded with finger pressure. It melts, and has a viscosity similar to that of water at a temperature of only 150° F., but—surprisingly enough—it will undergo no further changes until it reaches its flash point of about 800° Fahrenheit. Most thermoplastics tend to "burn up" when heated as much as 100 degrees over their respective melting points.

In its molten state, Plasticarve can be pigmented with virtually any powdered paint color and may be cast without parting agents in almost any type of mold—e.g., wood, metal, plaster, latex, plastics, and elastomer molds. The elastomer molds referred to are molds with rubber-like flexibility, such as the Nuplamold and Plastiflex varieties which are made by combining large quantities of plasticizer with the Goodrich Geon 101 polyvinyl thermoplastic.

If it is well stirred prior to casting, Plasticarve has no tendency to form air bubbles, and will almost immediately attain good surface hardness in the mold cavity even though



Left, plaster mockups on which Plasticarve sheet is hand-pressed to make the patterns at Century Engineering Company, Los Angeles. *Center*, the pigmented Plasticarve patterns. *Right*, the resultant outboard motor shrouds, made by sand-casting steel in the molds formed with the Plasticarve patterns.

Parts of intricate patterns may be joined by a soldering iron, and the assembly will be as strong as though made in one piece.

Plasticarve is cast in a sheet form which has been made by positioning four metal bars at precise intervals on a marble slab.

the entire mass may not become hard for an hour or more. Accordingly, if hollow casts are desired, it is only necessary to pour off all unhardened plastic in the center of the cast after the cast has been allowed to set for a minute or two. In any event, the time required for the plastic to cool to room temperature can be reduced to a few minutes by quenching the mold in water.

Cast forms of Plasticarve can be adequately heated, for the aforementioned hand-forming operations, in hot water. An example of how this feature may be advantageously utilized was recently encountered at Century Engineering Company, Los Angeles, where Tool Engineers made streamlind shroud patterns for an experimental outboard motor in less than an hour by heating Plasticarve sheets of the required thickness and hand-pressing those sheets to the contours of plaster mockups. When they had hardened, the plastic-sheet patterns were used to make sand molds in which the experimental shrouds could be cast with steel—and it was found that the entire tooling operation cost only about $100. If wood patterns, as normally used, had been fabricated for this job, the tooling cost would have been at least $700.

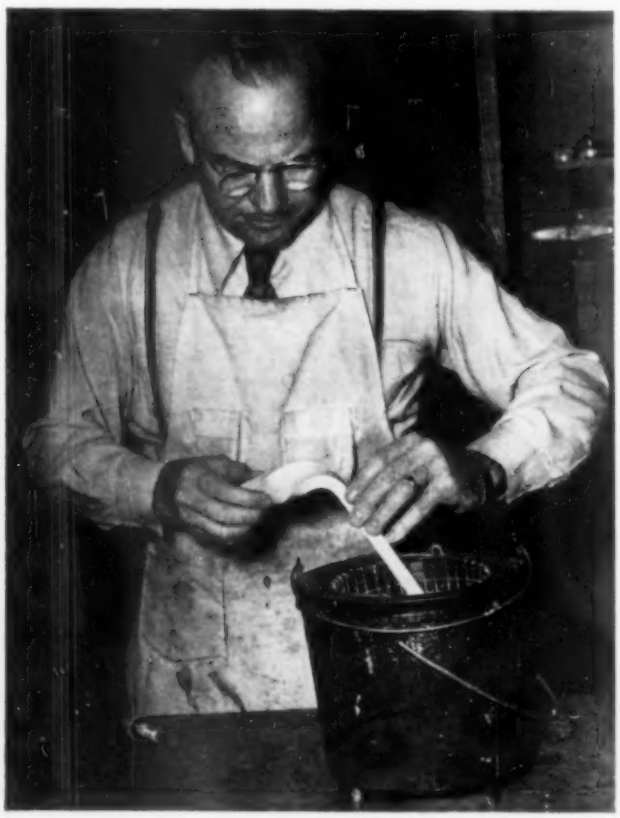
Now, Century engineers claim they could have saved even more by making both their mock-ups and patterns from Plasticarve. It would have been possible to handform the plastic patterns on mockups of the same material, because two Plasticarve articles will not adhere to one another unless they are fused by melting.

When Plasticarve articles become damaged, they can be repaired by fusion or filling-in with a soldering iron; and, after such repairs, they have as much strength as originals—can be smoothed over with a cutting edge until no seams or patches are apparent.

The injection molding of Plasticarve can be accomplished with conventional press equipment, and it is an especially desirable process for a number of special applications. At

Plasticarve is cast in a multi-piece plaster mold. The surfaces of the mold are neither lacquered nor waxed, because the molten plastic has no adhesive properties. If a hollow cast is desired, the material in the center of the cast can be poured off—leaving a hollow shell—a minute or two after the mold is completely filled.

After it has been dipped in hot water, Plasticarve can be readily hand-formed, as indicated here. Regardless of the extent of distortion, no internal stresses will result.



A block of Plasticarve is chiseled at room temperature. Models can thus be made with this new material because it does not have the grain that causes wood to split after extensive chiseling.

Intricast Company of Los Angeles, for example, intricate novelty articles are now being injection molded for use as substitutes for wax articles in connection with the "lost-wax" process.* This is especially advantageous because thermoplastics can be molded with fewer defects and greater speed than can wax, and because thermoplastics can be reclaimed after melting or otherwise removing from vacuum-formed plaster molds—whereas wax patterns must be discarded after melting down one time.

Plasticarve, softened by heat, is troweled onto a wire frame for use in producing a model. If the initial troweling isn't perfect, corrections can be made later with cutting tools or a soldering iron.

Three-dimensional models of automobile body designs are now being made from Plasticarve for Henry Dreyfuss of New York by Wellington E. Miller, Los Angeles body designer. Previously, Miller had to do his modeling in clay; and, because clay models are very easy to break when dry, he had to make plaster casts from each in order to attain design specimens that could be shipped to his clients. This often necessitated compromises in his original design ideas, because even the best grades of casting plaster cannot be used to make perfect reproductions of large articles.

With Plasticarve, Miller can handform models almost as easily as he could handform clay; and, if discrepancies of any type occur, even after the material has hardened, he can make perfect corrections by melting and/or filling-in as heretofore suggested. Then, when the initial modeling job is complete, he does not have to worry about plaster casts because Plasticarve articles have enough strength to be shipped when packed with reasonable care.

Plasticarve has also proved itself to be useful as a filler material which can be economically used in place of low-melt alloys for the bending of tubing.

The development of Plasticarve is the result of three years' work on the part of P. B. Crouse, a former aircraft production engineer who briefly describes his material as a "blend of thermoplastic resins and fillers." The material has been in production at Plasticarve Corporation, Pasadena, California, since September of 1946.

**For further information on the "lost wax" technique see, "The Process and Application of Lost Wax Casting," by H. W. Giesecke, July '46,* The Tool Engineer.

A sheet of Plasticarve is planed with a woodworking tool. Because the plastic has no abrasive characteristics, there is no danger of dulling the cutting edge.

Here is the experimental outboard motor whose streamlined shrouds resulted from use of Plasticarve patterns at Century Engineering Company, Los Angeles. It is scheduled soon to be produced by another Los Angeles concern.

By John E. Hyler

The Versatile Press Brake

A "Jack-of-All Trades" in Metal Forming, the Press Brake Provides Marked Economies in the Fabrication of Sheet Metal

Mr. Hyler

THE RANGE OF THE PRESS BRAKE in present-day operations is tremendous, largely due to the great range of sizes in which such machines are now being built. The various types of hand brakes used for sheet metal work are still readily available, and some of them are highly versatile. They are provided in different models by many manufacturers, depending on the work they will be chiefly called upon to perform. Universal hand brakes may be obtained which will make all bends required in modern sheet metal practice.

Heavy-duty machines have evolved for handling heavier materials. The advantage of such machines, in producing various shapes and units to be incorporated into different products in connection with arc welding, have made them very popular. Some very large machines of this kind have been specially built. One such machine has an overall bending surface length of 30 feet, and has been used in making right angle bends in cold steel plate ¾" in thickness, and 20 feet long. It can exert a maximum pressure of 1,000 tons. Like smaller press brakes of its type, it is capable of receiving various kinds of dies, for hemming, seaming, forming, punching, piercing, embossing, trimming and notching operations, to mention only a few.

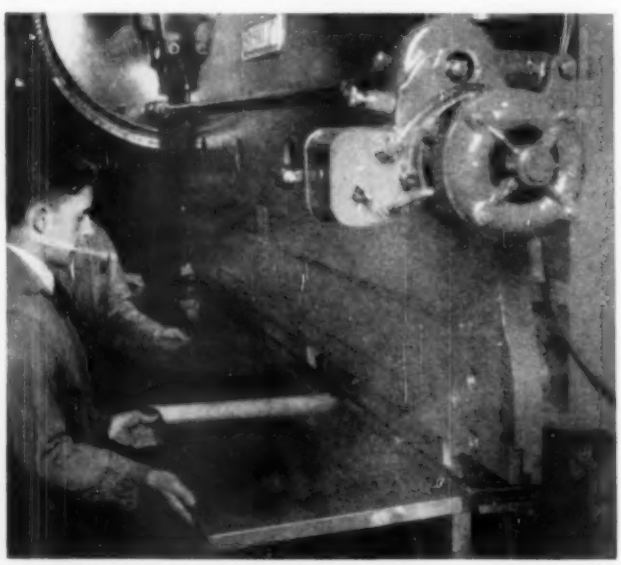
The modern heavy press brake is often used for progressive operations, on stock sufficiently short to allow it. There are many kinds of work requiring bends of complex type, or bends in conjunction with other operations where the complete job cannot be done with one set of dies. When two or three sets of dies are required to finish such a job, it is often possible to mount two or three sets of dies at different points along the press bed and ram, so that two or three operators—passing workpieces from one to the other—can progressively complete the entire job. With three sets of dies properly aligned in this manner, and three operators at work, the press can do three different kinds of work at each stroke of the ram, and a finished piece of material is produced at each stroke of the ram. Production setups of this general type are being used with increasing frequency.

It is very important, however, when more than one man is working on a progressive setup in this manner, to have a very level-headed mechanic as the leader of the group. This man is the one who will operate the press clutch, causing the ram to descend. He must have a full regard for the hands and fingers of the other men working at the press brake, as well as his own. Experience is the best teacher with regard to any given press brake job, especially concerning whether dies can be devised and produced that will allow the job to be done advantageously on the progressive basis. In some cases, the work is too long to be handled in this manner. In others, too much time and trouble would be involved in relating the dies to one another properly. It is always possible, of course, to make as many press brake setups as there are phases in the given job, if that is either necessary or desirable.

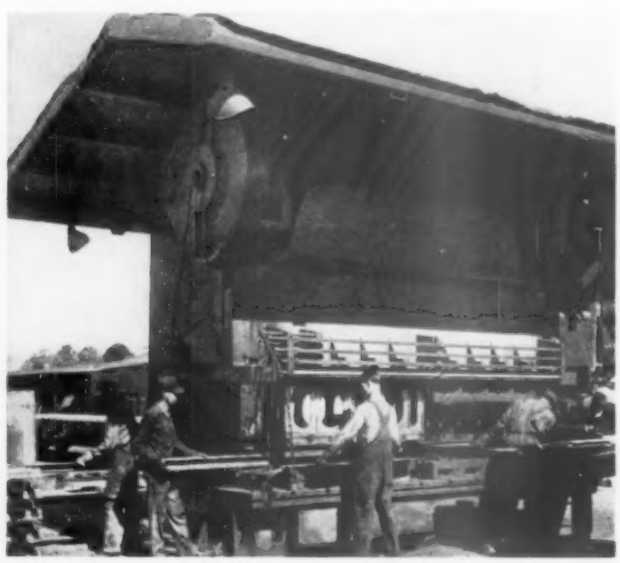
Hinges Made with 3-Stage Dies

A job often performed on the press brake is the making of continuous hinges. These are produced from two strips of metal which are notched out with special press brake dies to leave a series of tongues standing along the edge of each strip. The tongues left standing are just a little narrower than the notches themselves, so the two halves of the hinge will later fit together with proper working clearance. The ends of the tongues are then coined with a second set of press brake dies so they will fit against the main body of the hinge leaf properly when bent into the form of a loop. The looping operation is performed with a third set of dies. When the loops have been formed, the hinge leaves are con-

Metal panels are shown being processed. The press brake is set up for progressive notching and forming, with the final operation taking place in the foreground. This photograph, and all others in this article, courtesy Cincinnati Shaper Company, Cincinnati, Ohio.



Press brake used for progressive punching and forming of railroad car stakes. With one end of brake set for punching and the other for forming, a stake is completed at each stroke. It is reported that, on a lot of stakes, this press brake paid for itself in three months.



nected with a continuous pin. Some of these hinges are made of aluminum alloy, though stainless steel is also a favorite material.

A similar operation to the bending of these spaced loops on continuous hinge tongues, is the case in which uninterrupted beads or curls are made on the edges of sheet metal parts. The use of the press brake for processing edges, to get away from sharp revealed corners, usually takes the form of either bending such a bead, or of hemming, as it is called. There are several kinds of beading dies in use. Some are of a composite nature, so that all bending of the bead can be done at one press brake position, though in different stages. A three-stage die is the usual arrangement for this type of work.

Some beads or curls are made off-center, so as to leave no obstruction on one side of the metal sheet, though there are a few instances where on-center beads are desirable. These usually require an additional die stage for their proper making. While in the majority of cases, curled or beaded edges produced at the press brake require no internal support as they are bent, there are some instances where high accuracy is required (especially where small-radius beads are being made in relatively heavy metal) that it is necessary to form the bead around a wire. Larger curls can be made around mandrels, of diameters greater than wire if necessary, to maintain very high accuracy.

Tapered Work with Standard Dies

As a general rule, bending dies made up for use with the press brake are relatively simple, since the bend is usually the same from one end to the other, and therefore, the dies are exactly the same from one end to the other. However, this is not always true. In some instances, tapered tubes are produced at the press brake, for this machine is often employed in making both round and square tube sections. Where tapered tubes are made in large lots, it is naturally necessary to employ tapered dies.

In this connection, however, certain special tapered work is produced on some modern press brakes using standard bending dies. This has particular reference to bending conical sections. Cones are used in pressure vessels, in so-called cyclone separators for dust collecting systems, and in many other places. In getting out the blanks, it is of course necessary to develop a section of the surface of the desired cone. Upon this development, elemental lines can readily be laid out for use as bending guides.

If press brake dies in use can be arranged so that the ends of the dies working the "small" end of the cone section will approach one another closer than the other end, the small end will be bent to a smaller radius, which is exactly the result desired. Accuracy can be obtained if the action is fully controllable.

To this end, one very fine line of press brakes is designed and built with an incorporated ram-tapering mechanism. There is a ram-adjustment motor, by means of which either end of the ram can be adjusted as much as $\frac{1}{4}$" per foot of ram length. This is done without any trouble, for there are no bolts to loosen or tighten. The ram simply swivels on trunnions in the slides, any desired amount, to provide just the required "bending differentials" for production of any desired conical section.

Widely Used for Straightening

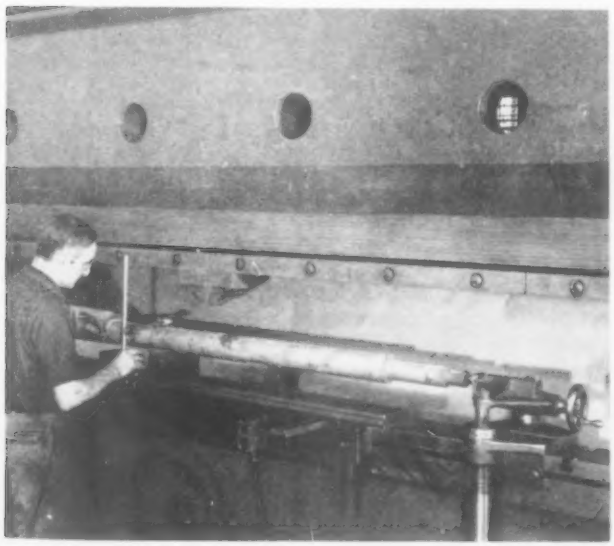
The press brake has also been widely used for straightening operations. Equipped with the proper kind of dies, it has been employed for straightening armor plate and similar flat-area duty, as well as for straightening hardened shafts and rolls. Flanging of different kinds is a standard press brake operation.

Corrugating is also an operation much performed at the press brake, since corrugating is an outstanding means of increasing strength without increasing the weight of sheet metals. In some instances, sheet metal is corrugated at the press brake in one operation, and curved in a direction at right angles to the corrugations, in another press brake setup, to form culvert piping. The dies used in the latter operation must be both curved and corrugated.

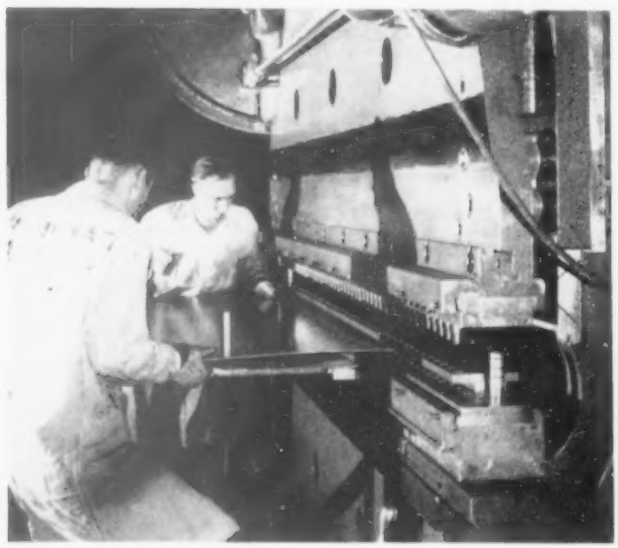
A study of dies used in connection with press brakes is highly interesting. In general, the female die must be used on the bed of the press brake, and the male die on the ram. This being true, scale very often collects in the lower die, and it is necessary to clean it out. Otherwise, it results in highly abrasive action on the die, wearing it prematurely. Where too much scale is allowed to collect in a form-fitting die, it has the effect of destroying the fit between the two dies and the metal being worked. This naturally causes much greater thrust to develop, which is hard on the machine.

There are some instances in which one could hardly call one die, male, and the other one female. This is the case,

Because the hardening of shafts and rolls causes some distortion, a straightening operation is necessary. Such a setup on a modern press brake is shown here. The parts are tested for straightness by holding them between centers in the press brake, itself, where the straightening is done.



Since a multiple punching job requires less power when some punches penetrate the sheet in advance of others, you will note the punches shown are not all set at the same engaging level. Material punched on such a press brake ranges from heavy steel plate to thin aluminum alloys.



for example, in offset dies where two bends are made at one time. Since the two bends in an offset are in reverse directions, both dies are combination male and female. Circumstances usually dictate whether offsets will be produced by making both bends at once, in the manner cited, or whether each bend will be made separately. There is a great production advantage in making both at once, naturally, but very heavy pressures are required. It usually depends on whether there is a press brake available with sufficient capacity to make the entire offset, in the thickness and type of metal at hand, in a single operation. If not, each bend must be made separately.

In certain kinds of forming, in the final bend, the nature of the work is such that a male die patterned on vertical lines will not allow the metal to bend into the required shape. Where this is the case, so-called gooseneck dies are used. These have one side of the die cut away, in such manner as to allow the metal to bend properly, and still allow ready removal of the material from the die.

Expanding Field of Applications

Since press brake dies are open-ended, the work can always be slid off the male die endwise, if necessary. Due to the cutaway construction of male gooseneck dies, they are weaker, and must not be seriously overloaded. The selection of high-strength alloy steel for making them is important, for the same reason. One broken die will be far more costly than the time required for making careful repetitive settings.

Many dies used on the bed of the press brake contain a female vee of given size and given degree of included angle. This being true, it has been found advantageous in many shops, to use what is known as a four-way die on the press bed. This die can have any one of its four different sides selected and turned upward, for a given job in hand. Each of the four sides is provided with a different type of vee or other female recess. Such a die, in a press brake of considerable length, is very heavy, yet it is a simple and easy matter to turn it over when it is desired to use one of the remaining three sides.

By mounting lifting studs in the ends of a four-way die, in an axial position, and using lifting studs in the ends of the press brake ram, special lifting links designed for the purpose can be set over the studs on both ends. Then, simply by raising the press ram high enough to lift the four-way die clear of its seat, it can be turned over on its axial lifting studs, until the desired side is upward, and again lowered into place with the press ram. The two lifting links used for this purpose are simply drilled on one end, but are slotted on the other. Thus, when the die is lowered into place with the ram, a bit of over-travel on the ram, downward, will not lock the links on the lifting studs.

In using ordinary vee-type dies for bending right angular corners, both legs of the metal being bent take a fast upward swing as the dies close. This causes no trouble when the parts being handled do not have great width, but when the width is great, the swing of the long legs is very fast at the outer edges, unless the press action has been made very slow. Due to this and other factors, so-called spring-pad dies have been used for bending right angles in such types of work. Using a die of spring-pad type, the leg of the metal held by the operator remains level, and the operation is both safer and better.

Multiple punching is one press brake operation sufficient in itself, in some shops, to justify the installation of such a unit. Multiple punching equipment used with press brakes is sometimes of fixed-center type. There is no good point served in the use of adjustable punching equipment, if one is handling only one or two standard jobs which never change. However, multiple adjustable punching equipment for the press brake is used by many who find it expedient. Some press brake manufacturers furnish either type of equipment for their machines.

In the aircraft field, there is much use for press brake punching equipment. A surprising number of rivets enter into the manufacture of modern metal aircraft. There are, in addition to regular press brake manufacturers, independent concerns who make punching equipment particularly suited for adjustable application to the brake. Some of these are punching units adaptable for setting up on the standard press brake bed, and are capable of being spaced longitudinally so as to punch any required number of holes with any type of spacing in a straight line.

There are also firms which provide special bolsters, applicable to the press brake bed, which greatly increase its width, and make it suitable for various jobs that could only be handled, otherwise, on blanking or forming presses incorporating wide beds. For these special bolsters, punching and blanking, as well as notching dies are provided.

Other Uses for Press Brakes

Many special-application press brake machines have been developed for certain specific types of duty, and manufacturers are naturally in a position to give full information as to what can be done along these lines. Rubber-pad female dies, which automatically adapt themselves to the contour of the male die, have found extensive use, and have greatly reduced the necessary number of die changes on relatively simple forming work.

Certain aspects of press brake operation have been left untouched in this article; but one thing is certain. This type of machine is definitely on the way forward, and will doubtless be made even more versatile in the days that lie ahead.

Straight Line Flow

At the recent meeting of the Society of Body Engineers, held in Detroit, it was predicted that assembly of automobile and commercial vehicle bodies will, in the future, be performed in a constant flow, using moving fixtures and automatic welding machinery.

This prediction, voiced by L. M. Benkert, Sales Manager of Progressive Welder Company, Detroit, would involve an entirely new concept in sheet metal fabrication. Nor would it be confined to motor vehicles; rather, it would embrace the manufacture of all types of sheet metal products, evolving into one "moving pattern," controlling production flow in much the same manner as a signal tower regulates switching operations in a large railroad yard.

While the machines are available today, Mr. Benkert said, it remains to correlate them in such a manner that production flow is continuous, thereby eliminating most of the handling, stacking and storage of parts and sub-assemblies between operations.

Tool Courses Approved

The Engineering Foundation of New York City announces, for the first time, accrediting of tool design courses at a technical institute. This institute—rated between high school and engineering college—is the Wentworth Institute, Boston, Mass., where courses in machine construction and tool design were formally approved.

This new accrediting program is a project of the foundation's Engineers' Council of Professional Development, and also a joint activity of such prominent groups as the American Society of Civil Engineers and the American Society of Mechanical Engineers. The aim is to insure a sound educational foundation for the practice of engineering.

Drilling and Boring Tools

Installment No. 7 of a Series

IN THE PRECEDING INSTALLMENT, we discussed standard fixtures and jig components. We now start a discussion on design of drill jigs—or rather, on *types* of drill jigs and fixtures, as well as their construction. It is not the function of this Department to teach mechanical drawing; hence, illustrations are mainly schematic. We aim to convey ideas that may be broadly applied.

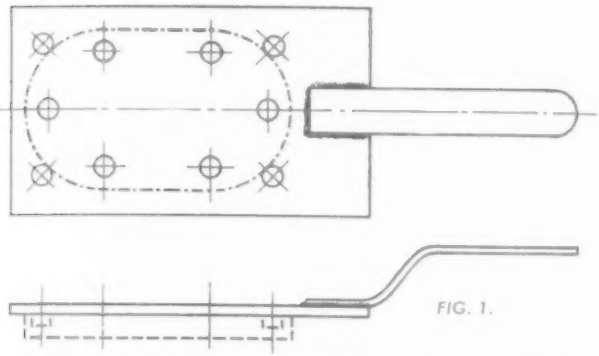
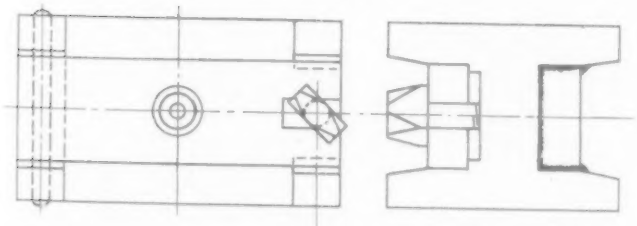


FIG. 1.

The simplest drill jig is the template, of which an example is shown in Fig. 1. These are usually made of sheet steel, or plate, and used with or without drill bushings. However, a bushing especially designed for templates was shown in Fig. 15, Installment No. 5, Dec. '46 issue, this series. Workpieces are usually located by pins, and the work may or may not be clamped, as occasion demands. If clamped, jig feet are provided, otherwise the workpiece rests directly on the drill press table.

Fig. 2 shows the popular box or "leaf" jig, introduced in this series by Fig. 14, January '47 issue, and widely used for small, light work. However, they are suited to the drilling of large parts as well. Essentially, these jigs consist of a body, which may be of welded construction (shown) or cast steel, semi-steel, cast iron or aluminum, provided with suitable locating points and a hinged cover or "leaf." The



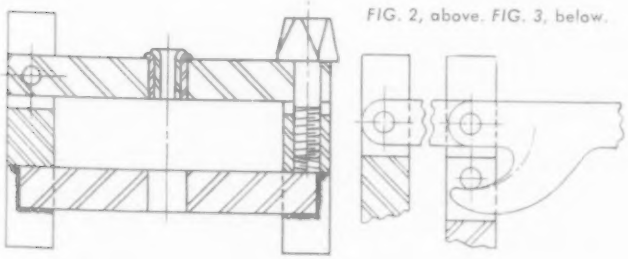


FIG. 2, above. FIG. 3, below.

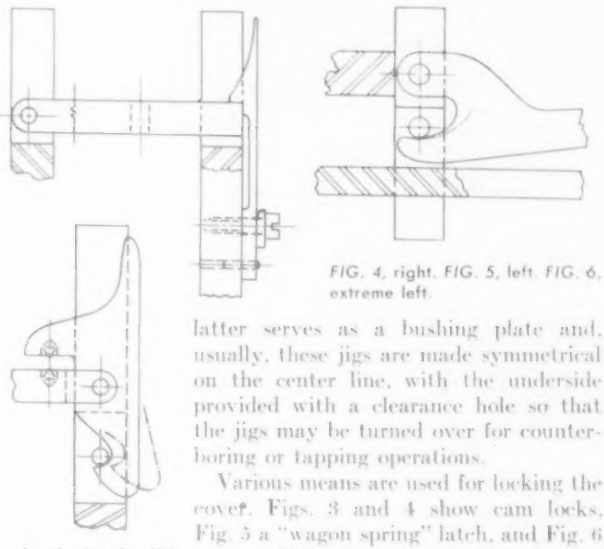


FIG. 4, right. FIG. 5, left. FIG. 6, extreme left.

latter serves as a bushing plate and, usually, these jigs are made symmetrical on the center line, with the underside provided with a clearance hole so that the jigs may be turned over for counterboring or tapping operations.

Various means are used for locking the cover. Figs. 3 and 4 show cam locks, Fig. 5 a "wagon spring" latch, and Fig. 6 a hook latch. The cam, which should have from 4 to 6 degrees rise approximately, usually forms part of a double handle, the other part of which is incorporated in the body, as in Fig. 6. In manufacture, the cam handle is usually left slightly above parallel, when clamped, for wear takeup. Cams and pins are hardened; however, the pin may be replaced with an oversize in event of wear.

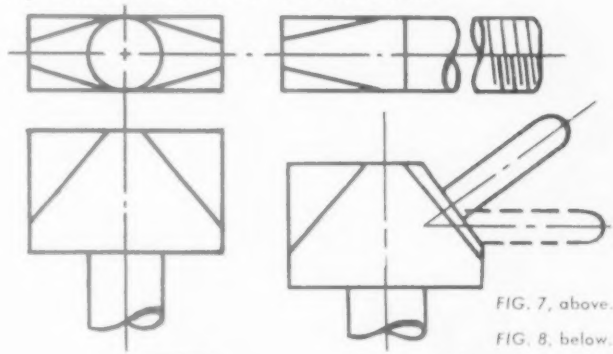
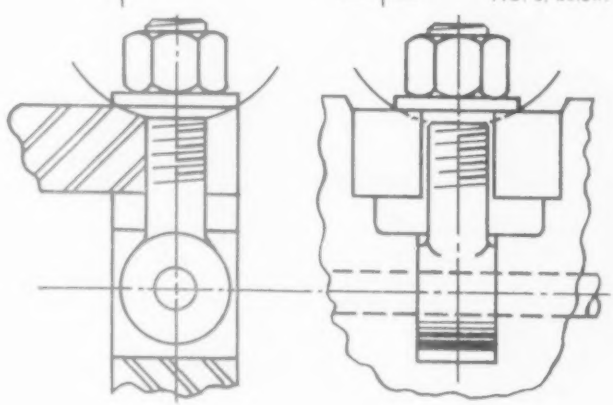


FIG. 7, above.

FIG. 8, below.



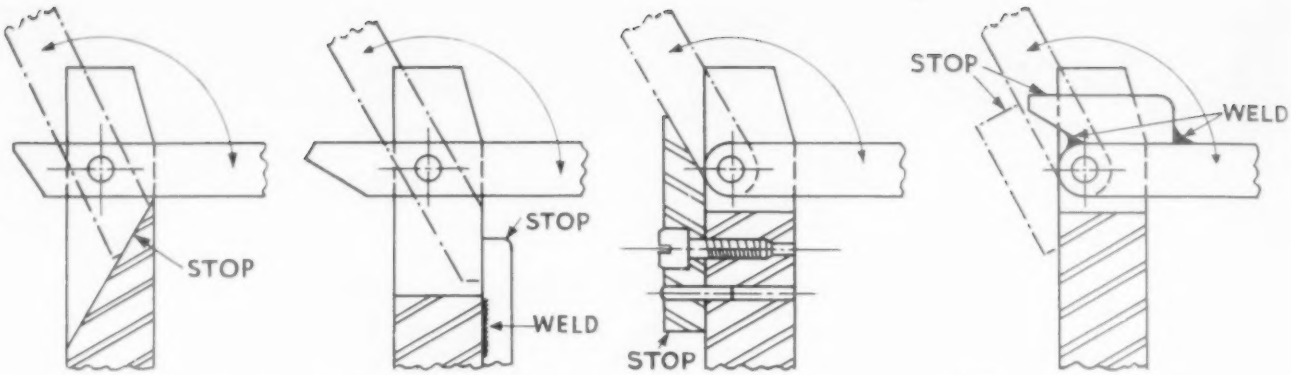
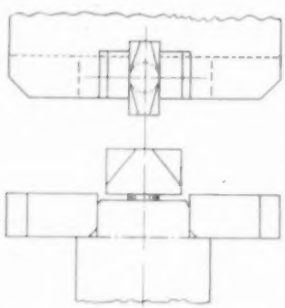


FIG. 9, A,B,C,D, above. FIG. 10, at left.



One of the most common types of lock is the quarter turn screw, shown in Fig. 7. This is made from flat stock, same thickness as the diameter of the screw, and bevelled for lead-on, as shown. Pin handles may be provided for leverage. They are installed soft, and the bottom face is turned until the head sets at an approximate 45°. It is then removed and hardened. The partial, initial turn provides for wear.

Another type of lock quite commonly used, but for heavier jigs, is the swinging eye bolt, shown in Fig. 8. While a hex nut is shown, a wing nut or tapped hand knob may be used. The bottom of the nut should be rounded, to seat in a dished washer. Preferably, however, the leaf should be dished, or the washer seated in a counterbore, to prevent creep.

For convenience, when using these jigs, they should be provided with leaf stops, as shown in Fig. 9, *A*, *B*, *C* and *D*. The leaf should come to rest at an angle from 15 to 30 degrees beyond vertical, so that it will "stay put" and not fall back and injure the operator. At *A*, the back post of the jig body and the leaf are milled at angles, while *B*, *C* and *D* have the stops welded on.

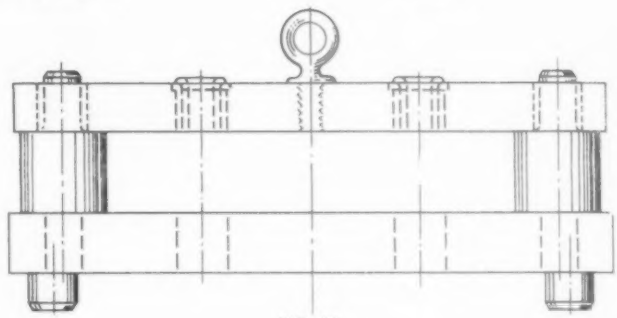
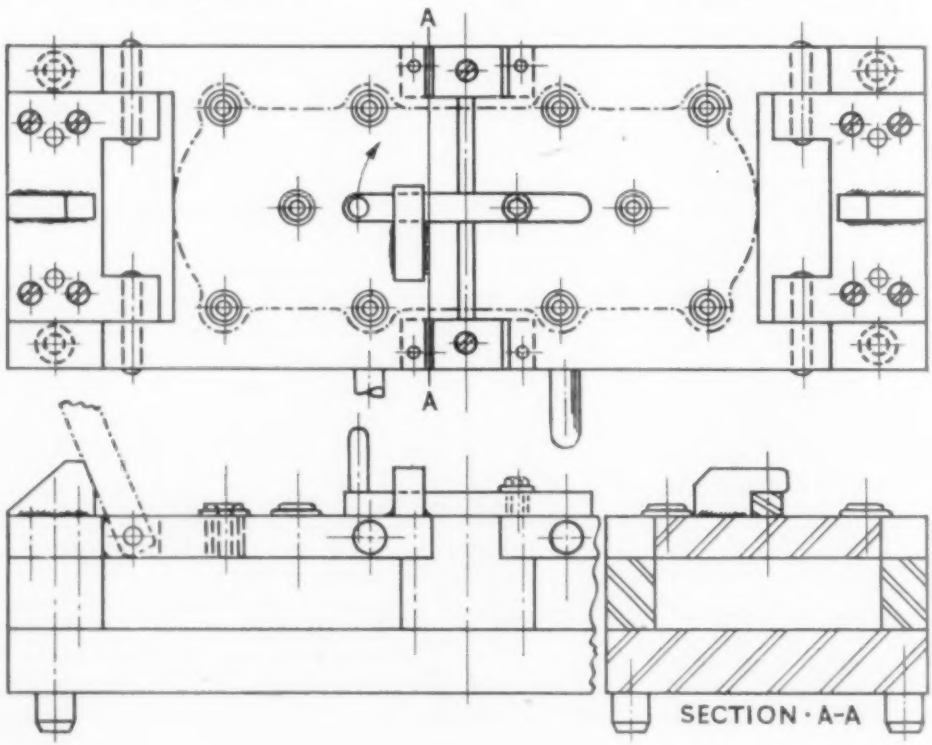


FIG. 11.

As shown in Fig. 2, the leaf is usually seated on a shoulder on the side members which also locates it laterally. Sometimes, however, a center post is used, as in Fig. 10. When so designed, both leaf and post are provided with bevelled lead-ons. In principle, however, this construction is comparable to that shown in Fig. 2; it's just that the order is reversed.

A variation of the leaf jig is shown in Fig. 11. Here, the leaf is entirely detachable and is located on hardened and ground guide posts, with hardened and ground bushings in the cover plate. Rest is against shoulders on the guide posts. This type of jig is not reversible, and is therefore used mainly for one side only drilling in heavy work. The leaf is provided with an eye bolt for mounting and removing with a hoist.



Shown in Fig. 12 is a heavy leaf jig with twin cover plates. This, too, is designed for large and heavy work, and the dual plates reduce weight when lifting. Stops are welded on, as shown, and the latch is a swinging bar. Once locked, it "stays put." As shown, this jig is provided with feet, to slide on the drill press table; however, it may be clamped to the table when used in connection with a radial drill.

It may be added, here, that there has been little attempt at consistency in the several illustrations. Rather, we have tried to show variations in design and construction; the reader has his choice. Neither have we gone into detailed description at this time, as this will be taken up later in the series.

FIG. 12, left.

End of Part 7, Installment No. 8 will follow in the March issue, The Tool Engineer.

A·S·T·E· NEWS

We're Going to Houston . . .

Society Meets In Southwest

MONUMENT TO modern engineering, Houston, the Southwest phenomenon, will stimulate, inspire and amaze visitors to the Society's Fifteenth Annual Meeting at the Texas industrial hub, March 19, 20, 21 and 22. Every ASTE member, who can possibly arrange to make the pleasant late winter trip south, will want to see for himself how, by recruiting scientific brains, this much-talked-about inland city has made itself a great seaport, the country's leading oil producing, processing and distribution center; and a stronghold of the chemical industry, all served by busy metalworking plants.

Some of the executives and technicians who have helped develop Houston's industry will participate in the ASTE convention program at the Rice Hotel, along with industrialists, educators and engineers from other parts of the country.

As the revised program is now shaping up, the first national gathering of the Society, since the Cleveland meeting last April, will open Wednesday afternoon, March 19, with a session on "Crush and Diamond Dressing of Grinding Wheels," keynoted by Frank J. Tone, Jr., Vice-President and General Sales Manager of The Carborundum Co., Niagara Falls, N. Y. Mr. Tone's discourse will treat the "Development and Selection of Wheels." Son of one of the company's founders, he has been associated with Carborundum in various capacities for 20 years.

Ernest V. Flanders, Chief Engineer, Thread Grinding Div., Jones & Lamson Machine Co., Springfield, Vt., will draw upon his long specialization in this field for his paper, "Grinding Wheel Applications." He and his brother, Ralph E. Flanders, are joint holders of the Longstreth Medal awarded by Franklin Institute for outstanding achievements in developing thread grinding machinery.

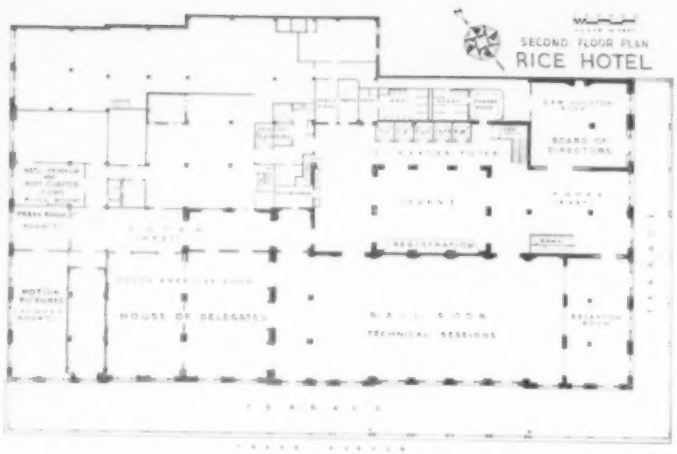
One of the country's most successful production stimulants will be explained Wednesday evening, when James F. Lincoln, President, The Lincoln Electric Co., discusses "Incentive and Enterprise." By use of "intelligent selfishness," the Cleveland arc welder manufacturer has been able to reduce prices as much as 75%, increase employment 400%, dividends from $2.50-$6.00 per share, and average yearly earnings of production workers, 450%.

"Keeping the price of goods up," declares Mr. Lincoln, "to support high wages paid on some basis other than the amount of goods produced is a sure way to throttle production, close down industry and lure the people into dependence on government for their livelihood."

A. A. Nicholson, Assistant to Vice-President, The Texas Co., New York City, is highlight speaker for the Thursday morning meeting, "The Tool Engineer Looks at Oil." In this program, tool engineers will hear a non-technical presentation of how oil is found, processed and developed into the widely diversified products now on world markets. The Texas Co. is preparing a number of special slides to illustrate the saga of Houston's leading industry.

Two of Texas' newer ventures, "Magnesium and Plastics," will be described Thursday afternoon by N. D. Griswold, Assistant General Manager, Texas Div., The Dow Chemical Co. At nearly sea-level Freeport, Dow pumps in the warm Gulf waters from which magnesium is more easily extracted, ships out the lightweight wonder metal. Into the big coast works is also piped the natural gas stripped from oil, to emerge as new chemicals and plastics.

The question of whether or not tool engineering is an engineering science and why will be debated during the



Thursday evening symposium, "The Professional Approach to Tool Engineering." Prof. Halsey F. Owen of the Industrial Engineering Dept., Purdue University, Lafayette, Ind., will present the first phase, "Manufacturing Analysis," an expose and resume of the approach to and content of this keystone subject. Prof. Owen will also outline financial and technical aspects of this new coverage of the science of tool engineering, as well as ASTE's activity in the clarification of the subject and preparation of texts.

"What Industry Expects in the Development of Tool Engineers," a topic pertinent to every member of the Society, will be expounded by William D. Merrifield, Assistant to Director of Technical Education, Chrysler Corp., Detroit. Mr. Merrifield's experience in both production and educational circles gives him an accurate perspective. Dr. Willis R. Woolrich, Dean of Engineering at the University of Texas, will answer Mr. Merrifield's challenge with "What Education Can Do in the Development of Tool Engineers." A distinguished technical author, Dr. Woolrich was a practicing engineer before devoting himself to teaching in industry, government and institutions of higher learning.

Houston's importance in another field will be demonstrated Friday morning when "Specialized Precision Instruments" are studied. Lecturers at this meeting will be J. H. Dunaway, Sr. Research Geophysicist, Humble Oil & Refining Co., and I. K. Fussell, Production Engineer, Schlumberger Well Surveying Corp., both of that city.

Mr. Dunaway will explain the "Manufacture and Use of Geophysical Instruments." Collaborating with him in the preparation of his paper are: A. Barry, Design Engineer; S. E. Swain, Shop Superintendent; and D. Blair, Gravity-Shop Foreman, all of the Humble organization. Mr. Fussell's talk will deal with "Precision Instruments Used in Oil Well Surveying."

Industrial sponsor for "Principals of Design for Carbides, and Unusual Applications," the Friday afternoon technical seminar, is Kennametal, Inc. Philip McKenna, President, and W. L. Kennicott, Chief Engineer, will present the two phases of the subject. Both are well-known technical speakers among their fellow members in the Society.

Highlight of the final session Friday evening will be the address by Col. Willard F. Rockwell, President of Rockwell Manufacturing Co., Pittsburgh. Col. Rockwell will keynote the theme, "Business and the Manufacture of Special Valves and Meters." Beginning as a $6 per week repairman for a Boston telephone company, while a student at M.I.T., Col. Rockwell now distributes million dollar Christmas bonuses to the employees of his 12 companies from New York to California. Technicians from the Rockwell California valve plant and the Pittsburgh meter works will follow Col. Rockwell with discussions of valve and meter manufacture and application.

Chairmen for the respective technical sessions are: F. J. Schmitt, Director of Sales, D. A. Stuart Oil Co., Chicago; E. W. Baumgardner, Prod. Eng., Industrial Ovens, Inc., Cleveland; F. E. Doty, Jr., Owner, Engineering Sales Co., Houston; Stephen Urban, Tool and Gage Eng., Pratt & Whitney Div., Niles-Bement-Pond Co., Syracuse; O. W. Winter, Vice-Pres., Acme Pattern and Machine Co., Buffalo; Homer Briggs, Asst. Chief Tool Eng., Reed Roller Bit Co., and Dean Saurenman, Chief Tool Eng., Baker Oil Tool Co., both of Houston; H. E. Linsley, Machine Tool Editor, *The Iron Age*, New York City; and R. W. Ford, Sales Eng., Ex-Cell-O Corp., Pittsburgh.

Of especial interest in the three morning film programs is "Oil for Tomorrow," a production of the Humble Oil & Refining Co., whose home office is at Houston. The 45-minute motion picture will show many ramifications of the petroleum industry and its ever-broadening role in the future.

A sequence of afternoon plant tours will demonstrate applications and problems of tooling peculiar to this industry.

Only three business meetings have been scheduled. Thursday morning the House of Delegates will assemble; in the afternoon the Board of Directors will open its Annual Meeting. Friday evening the National Membership Meeting and installation of newly-elected National Officers will take place.

* * *

The sober realities of implementing a low-cost, high-production economy, under adverse conditions, will be leavened on Saturday with an all-day Texas rodeo and barbecue at a cattle ranch in the Houston area.

Arrangements are now in progress for a "Quiz of Two Cities" broadcast Thursday evening between a group of ASTE'ers at Houston and a competing Society team in New Orleans.

For the first time since prewar meetings, special activities are being planned for ladies accompanying convention registrants. A delightful feature of their entertainment will be the Thursday afternoon visit to two private estates to view the display of azaleas and other spring blooms. One of Houston's leading department stores will award gift certificates as door prizes at the style show luncheon in the Rice Hotel, Friday noon. The feminine visitors will also be guests at the Texas Day rodeo and barbecue. Throughout the convention a bridge parlor in the Rice Hotel will be reserved for the ladies' convenience.

Reservations for hotel accommodations must be made immediately on forms furnished by the Society and mailed directly to the Houston committee. Since few rooms will be available for single occupancy, members should make their plans accordingly. Presentation of a current ASTE membership card will be required for registration. Non-members must present credentials identifying them with the tool field or allied industries.

Further details of convention activities will be found in subsequent pages.

1 Rice Hotel, ASTE Headquarters
2 Southern Pacific Depot
3 M.K.T. Depot
4 Union Depot
5 Greyhound Bus Station
6 Bowen Bus Station
7 Lamar Hotel
8 San Jacinto Hotel
9 Milby Hotel
10 Cotton Hotel
11 Texas State Hotel
12 Sam Houston Hotel
13 William Penn Hotel
14 Ben Milam Hotel

. . . *To Present*

Fifteenth Annual Meeting Program

Rice Hotel, Houston, Texas, March 19-22

Wednesday, March 19

9:00 A.M. **Registration, *2nd Floor Lounge***

9:00 A.M. **Educational Films, *Lacquer Room***

2:00 P.M. **Technical Session, *Ballroom***

Chm., F. J. Schmitt, Chicago Chapter

"Crush and Diamond Dressing of Grinding Wheels"

"Development and Selection of Wheels"
Frank J. Tone, Jr., Vice-Pres. and Gen. Sales Mgr., The Carborundum Co., Niagara Falls, N. Y.

"Grinding Wheel Applications"
Ernest V. Flanders, Chief Eng., Thread Grinding Div., Jones & Lamson Machine Co., Springfield, Vt.

2:00 P.M. **Plant Tour—Emsco Derrick & Equipment Co.**

8:00 P.M. **Technical Session, *Ballroom***

Chm., E. W. Baumgardner, Cleveland Chapter

"Incentive and Enterprise"
James F. Lincoln, Pres., The Lincoln Electric Co., Cleveland, Ohio

Thursday, March 20

9:00 A.M. **Technical Session, *Ballroom***

Chm., F. E. Doty, Jr., Houston Chapter

"The Tool Engineer Looks at Oil"
A. A. Nichoson, Asst. to Vice-Pres., The Texas Co., New York City

9:00 A.M. **House of Delegates Meeting, S. *American Room***

9:00 A.M. **Educational Films, *Lacquer Room***

2:00 P.M. **Technical Session, *Ballroom***

Chm., Stephen Urban, Syracuse Chapter

"Magnesium and Plastics Fabrication"
N. D. Griswold, Asst. Gen. Mgr., Texas Div., The Dow Chemical Co., Freeport, Texas

2:00 P.M. **Board of Directors Meeting, *Sam Houston Room***

2:00 P.M. **Plant Tours—Hughes Tool Co., Reed Roller Bit Co.**

8:00 P.M. **Technical Session, *Ballroom***

Chm., O. W. Winter, Buffalo-Niagara Frontier Chapter

"The Professional Approach to Tool Engineering"

"Manufacturing Analysis"
Prof. Halsey F. Owen, Dept. of Ind. Eng., Purdue University, Lafayette, Ind.

"What Industry Expects in the Development of Tool Engineers"
William D. Merrifield, Asst. to Director of Technical Education, Chrysler Corp., Detroit, Mich.

"What Education Can Do in the Development of Tool Engineers"
Dr. W. R. Woolrich, Dean of Engineering, University of Texas, Austin, Texas

Friday, March 21

9:00 A.M. **Technical Session, *Ballroom***

Co-Chm., Homer Briggs and Dean Saurenman, Houston Chapter

"Specialized Precision Instruments"

"The Manufacture and Use of Geophysical Instruments"
J. H. Dunaway, Sr. Research Geophysicist, Humble Oil & Refining Co., Houston, Texas

"Precision Instruments Used in Oil Well Surveying"
I. K. Fussell, Prod. Eng., Schlumberger Well Surveying Corp., Houston, Texas

9:00 A.M. **Educational Films, *Lacquer Room***

9:00 A.M. **Board of Directors Meeting, *Sam Houston Room***

2:00 P.M. **Technical Session, *Ballroom***

Chm., H. E. Linsley, N. New Jersey Chapter

"Principles of Design for Carbides, and Unusual Applications"
Philip McKenna, Pres., W. L. Kennicott, Chief Eng., Kennametal, Inc., Latrobe, Pa.

2:00 P.M. **Oil Well Drilling Rig Demonstration**
Location to be announced

7:30 P.M. **National Membership Meeting and Installation of Officers, *Ballroom***

8:30 P.M. **Technical Session, *Ballroom***

Chm., R. W. Ford, Pittsburgh Chapter

"Business and the Manufacture of Special Valves and Meters"
Col. Willard F. Rockwell, Pres., Rockwell Manufacturing Co., Pittsburgh, Pa.

Saturday, March 22, Texas Day

10:30 A.M. **Trip to LH-7 Ranch**
Noon, Barbecue; 2:30-5:30 P.M., Rodeo

Ladies Program

Thursday Afternoon, March 20
Azalea Trail—Visit to private estate gardens

Friday Noon, March 21
Style Show and Luncheon, Empire Room, Rice Hotel

Saturday, March 22, 10:30 A.M.
Trip to LH-7 Ranch for Barbecue and Rodeo

J. C. Lincoln

F. J. Tone, Jr.

W. F. Rockwell

E. V. Flanders

I. K. Fussell

Philip McKenna

N. D. Griswold

H. F. Owen

Above: A forest of derricks sprouts from the flat Texas landscape in the rich oil fields surrounding Houston. Drilling rig demonstration is part of the ASTE convention program. Below: Flowing wells are topped with a "Christmas tree" or control head assembly. Sub-surface pressures are regulated; oil and gas separated

. . . We'll Look at

From Bits to Derricks

GREATEST IMPETUS to mechanical inventions was the discovery of oil in the United States less than a century ago, relieving the scarcity of other lubricants, that threatened to check the progress of the machine age. Vital factor in maintaining a stream of oil sufficient to keep pace with a mechanized world was the development of improved precision cutting tools, biting farther into the earth to tap deep petroleum pools.

The making of these rotary rock bits will be shown as part of the Thursday afternoon program of the Houston convention, when Hughes Tool Co. and Reed Roller Bit Co., outstanding manufacturers of oil well drilling tools and appliances, will be hosts to the Society for tours of their plants.

Ranging from $3\frac{3}{4}$" to more than 26", the rock bit consists of a large collar to which are attached two or three rotating cones with closely placed sharp teeth. For shallow, broken formations near the surface, the two-cone bit is used; harder rock met at greater depths yields to the three-cone bit.

Texas shale is unlike that of Ohio, while California rock formations are frequently struck at an angle. Bits are designed to meet these varying conditions and, when worn, are returned to the manufacturer for study, as a basis of experiment with other types of tooth structures. Factory research and laboratory tests are constantly being conducted to increase cutting speed and wear resistance of the drill teeth.

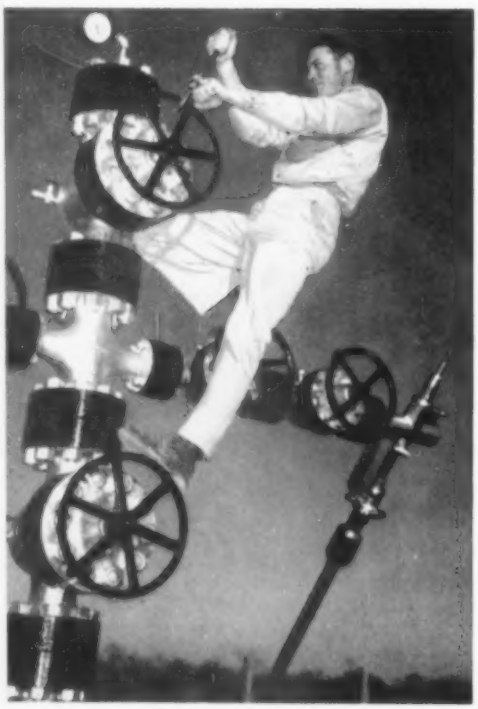
Adoption of the rotary bit dates back about four decades, during the original oil boom in Texas, when an Iowa lawyer, Howard R. Hughes, Sr., became interested in the theory of a rotary drill to replace the fishtail bit which had little effect on hard rock formation. The substitution of multi-cone bits combining a scraping and chipping action revolutionized the drilling of oil wells.

From the small plant set up by Mr. Hughes and his associate, Walter B. Sharp, has grown the present 75-acre Hughes Tool Co. with a bit business extending around the world. Present owner of the company is Howard R. Hughes, noted aircraft designer-flyer and scion of the company's founder.

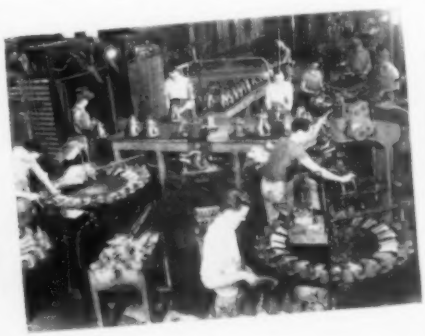
A few years after Lawyer Hughes had set up his rotary bit enterprise, a Pittsburgh accountant, named C. E. Reed, conceived an idea for an oil well rotary drilling tool. With J. H. Giesey, an architect friend, as partner, he opened a small shop in Houston, heart of the Texas oil industry where the more advanced rotary drilling was favored over the cable tool method used in Eastern oil fields.

The inexperience of its owners nearly proved disastrous to the infant company entering a well-dominated field. But the quality of their product enabled them to survive the hazards of inadequate capital and lively competition. With its main plant now occupying a 28-acre tract in Houston, the Reed Roller Bit Co. maintains branch plants or representatives in other oil producing sections of the U. S. and Canada and is known wherever drilling rigs are operated.

The tool plant trips will be preceded by a visit Wednesday afternoon to the Emsco Derrick & Equipment Co., now engaged in constructing the largest oil field derrick ever built. One of the oil industry's latest developments is the "jackknife" or collapsible derrick which can be transported by truck, set up, dismantled and hauled away for use elsewhere. A feature of the Emsco tour



Below, left: This crew at Hughes Tool Co. welds hard metal on tool joints. Center: Rock bits are assembled for welding of head on this line at Reed Roller Bit Co. Right: Teeth on Hughes rock bit cones are washed on a special milling machine. Both companies will open their plants to ASTE convention visitors



Oil Field Tools

In Plants, On the Job

will be the assembly of one of the huge draw-works used in the derricks.

On Friday afternoon a drilling rig will be seen in action at one of the many oil fields surrounding Houston. Since oil is where you find it, the exact scene of operations will not be known until shortly before the convention.

Preliminary to drilling a well, geologists determine through test blasts or other means, the location of rocks, salt domes or other geological structures that might hold the precious fluid. A steel derrick is then erected over the site, for lowering and raising by block and tackle 20-40 foot sections of pipe to drill and line the well. A blowout preventer or master control valve in the derrick floor forestalls the dreaded catastrophe of a well blowing out from the tremendous pressure of oil, gas and water prevailing in subterranean depths.

Through a chain of drives, the drill bits attached to the lower end of the pipe, are rotated. Drilling mud, pumped through the pipe to keep the bits from fusing, also helps plaster the bore and control dangerous pressures.

As the drilling mud is forced back up in the space around the pipe, cuttings brought to the surface indicate the strata being drilled. More than two miles of pipe may be needed to reach deep wells. If the pipe breaks, the drill must be withdrawn or a new hole begun; if high pressure is encountered, the tools may fly back, wrecking derrick and equipment. Ever present is the element of chance which lends zest to the search for oil.

Increased drilling depths and well pressures have challenged the ingenuity of engineers in developing heavy mechanical equipment to prevent blowouts with their prodigious waste of oil and gas. Latest model blowout preventer works with the same ram-type principle introduced a quarter of a century ago, but with many refinements.

The piston-like rams move horizontally through cylindrically bored passages in the body of the device as opening and closing pressure is applied. The face of each ram is concave and fitted with a resilient packing medium which mates with an identical face on the opposite ram to form a tight seal.

When the oil pool is reached, the shaft lined with concrete encased steel, and a flow of petroleum established, the well is topped with a control head assembly called a "Christmas tree." The derrick is then moved to another site. As the fluid rises from its deep source, it flows to oil and gas separators. After natural gasoline and other products are extracted, the then dry gas is often returned underground through input wells, to maintain pressure needed to prolong the natural flow of wells and defer the time when oil must be pumped.

The crude oil pours into field storage tanks, eventually moving to refineries. Here it is cooked in "bubble tower" stills where the rising vapors are collected on platforms at various levels, utilizing the principle employed thousands of years ago by Arabs who hung wool fleeces above boiling oil, wringing out the resultant distillation.

Rising to the top of the fractionation tower, the lightest fumes become gasoline; at the lowest level, asphalt settles. In between are kerosene, fuel oil, paraffine and other derivatives subsequently made into the thousands of products which today's scientists have so magically evolved from the disintegrated animal and vegetable life existing millions of years ago when the world was comparatively young.

Above: Duplicating actual drilling conditions, these laboratory workers test cutting speed and wear resistance of rotary drill, by boring granite block. Below: A blowout preventer casing is about to be unloaded from a 5,000 ton press

Below, left: This manipulator handles a hard steel billet for the 600-ton press forging Reed Drill collars. Right: Part of the Emsco Derrick & Equipment factory, also on the Society's plant tour schedule

. . . Thrill to a Rodeo . . . Feast on Barbecue

All's Play On "Texas Day"

BUSINESS AND technical cares behind, a day of recreation ahead, Saturday's convention crowd will perk with excitement over the big-time Texas rodeo and barbecue being arranged by the Entertainment Committee. (Psst, in cowhand circles, it's rodeeo instead of the more academic rodayo.)

By mid-morning, buses will start conveying the excursionists to Emil H. Marks' LH-7 Ranch, 20 miles out on the prairie. There the tantalizing aroma of browning meat, basted in its own juices and flavored by the post oak coals over which it turns, will rise from the barbecue pits. By noon, when appetites have been whetted to a keen edge, the roasted whole steers will be ready for carving by expert ranch cooks.

Spiked with ranch beans, potatoes and other accessories, the succulent beef becomes the *piece de resistance* of a repast rivalling any formal banquet menu.

Thus fortified, the engineers, their spouses and guests mount the stands reserved for the Society, ready for a breathtaking, colorful, action-packed afternoon of Western riding stunts, punctuated with their own cheers.

On trained horses, the rodeo contestants, picturesque in broad brimmed hats, bright silk shirts, chaps and high heeled boots, parade by the spectators to the music of a cowpoke band.

Then a pitching, rearing bronc bursts through the corral gate bearing a rider supple as a ballet dancer . . . and the show is on! In a few seconds, the contest between man and horse is decided. If the cowboy is tossed, he loses both prize and entry fee; if the horse does not perform, the man gets another chance.

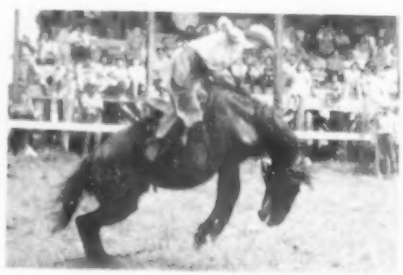
Trick roping, calf branding, bareback riding and bulldogging events follow fast and furiously, each according to the rules of the sport. Roping contests are timed, with the steers or calves given a head start. The horse assists his rider in keeping the rope taut, but must not drag the captured animal.

Branding must satisfy judges as to technique and be completed within the designated time . . . a bareback rider has only a rope grasped in one hand to help him keep his uncertain seat; his other arm must be extended . . . leaping from his running horse, a bulldogger seizes the horns of a plunging steer, must stop the animal before twisting him down.

Comedy relief for the tense, dangerous spectacle is the capering of a clown and his trained mule. Besides amusing the audience with his antics, the funnyman darts in at critical moments and diverts infuriated animals from charging their fallen riders.

. . . It's all part of the fast-moving, vivid pageant you'll see when Houston Chapter entertains its fellow members in the Texas cow country tradition.

NOTE: Ladies are cautioned to wear comfortable, low heeled shoes and casual sports clothes for the ranch trip.



Above: A critical moment. Who will win, man or beast? Right: Many hands make light work in the barbecue production line. Left: Sharp cutting tools are necessary here, too. Below, left: Exhibition of trick roping will be a feature of the Texas Day rodeo. Right: Landing stiff-leggedly, this bronc hopes to dislodge his rider

. . . Admire Our Hustling Host

HOUSTON HUSTLED to catch up with New Orleans; it's hustling to surpass Cleveland and Los Angeles, to fulfill Lloyd's of London's prediction of a three million population by 1980, or maybe the less conservative opinion of observers who prophesy that it will eclipse even New York and Chicago.

Fastest growing city of the Southwest, Houston knows not the lethargy common to Southern latitudes. Its seemingly inexhaustible energy and enterprise have swelled its population to 675,000 in the 111 years since its founding after Gen. Sam Houston wrested Texas from Gen. Santa Anna and his numerically superior Mexicans in the battle of San Jacinto.

Houston first busied itself with lumber and real estate, then cotton and cattle. Looking beneath the surface, it discovered and grew rich on the vast oil supplies, gas, sulphur and salt.

By 1910, these and related activities brought the number of inhabitants to 78,000. But Houston still had a fever of discontent, cast longing eyes at the Bay of Galveston just 25 miles away, emptying into the Gulf of Mexico. Only connecting link was a muddy trickle of water known as Buffalo Bayou, wandering aimlessly down to the Bay. With characteristic enthusiasm, Houston secured Federal aid and dug itself a 34-foot deep ship channel which opened to world shipping in 1915.

Now the world's biggest oil port, it is second in the nation in deep sea tonnage. Its proximity to the Panama Canal and the other Americas give it an enviable advantage in handling a rich peacetime trade with the Orient and the Pan-American countries.

Lining the banks of Houston Ship Channel are big refineries, synthetic rubber, chemical, steel and cement plants, shipyards, paper and flour mills and grain elevators. Within five years, it is expected that this marine highway will be crowded with industry. But this contingency is already being anticipated in another navigation project planned for the Trinity River.

Basic element in Houston's prosperity is the wealth of petroleum extracted from the 271 surrounding oil fields and processed in the 14 refineries ringing the city. This, in turn, has made it one of the country's principal oil tool and equipment manufacturing centers and a leading steel fabricator for the oil industry. Metal working in Houston ranges from production of the most delicate geophysical instruments to blast furnaces and rolling mills.

Another offshoot is its new hydrocarbon chemical industry which, by laboratory sleight of hand, converts oil and natural gas into an amazing array of plastic and chemical products, including toluene, butadiene, styrene, ammonia, isopropyl, dry ice, carbon black, alcohol, solvents, acetylene and hydrogen, methyl cellulose and plastics for consumer goods and industrial purposes. A process has even been developed for making nylon from an acid by-product of petroleum—in fact it is estimated that a million new organic compounds will be produced from oil and gas.

With a stream of $400,000,000 being poured into peacetime industrial expansion, it is small wonder that "million" is the Houstonian's favorite descriptive term. Commercial construction projects include a two-block, $9,000,000 department store and several skyscrapers.

Houston produces nearly all kinds of building materials, including heavy ceramics; makes tin cans and other containers, fertilizer, leather goods and candy; processes coffee, meat, rice, sugar and shortening.

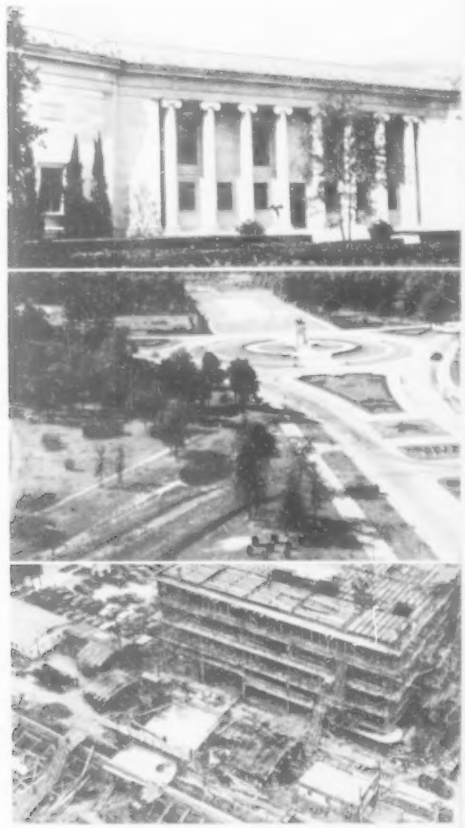
Agriculture, too, contributes to the success picture. Besides being the hub of a great cotton raising area and the nation's leading spot cotton market, Houston is the center of the second largest rice growing section in the U. S., and practices extensive truck farming. Livestock raising is still one of its major pursuits.

Goods exchanged in its world-wide maritime commerce, craftwork from Mexico, and the products of its own artisans are displayed in Houston's fine stores, along with the newest merchandise from other manufacturing centers.

Houston has its cultural side, too. Its two universities, Rice Institute and the University of Houston, offer broad educational programs. At Rice, its oldest institution of higher learning, tuition is free and engineering courses have the approval of the Engineers' Council for Professional Development.

It supports a large and well-filled Museum of Fine Arts, leans toward Old Masters rather than the modern school. Its symphony orchestra plays

Above: Houston's office buildings house nationally-known organizations; others are under construction. Below, top: Many collections of valuable paintings, sculpture and other works of art are displayed in the large and well-filled Museum of Fine Arts. Center: Hermann Park is one of the breathing spots where Houston relaxes from its strenuous development program. Statue of Gen. Sam Houston dominates entrance



Above: This $9,000,000 two-block department store is one of many large commercial and industrial building projects underway. Postwar expansion plans call for nearly a half-billion dollars worth of new construction. Below: The second largest rice crop in the country is harvested in the Houston area. Sowing and weeding by airplane and reaping by combine, Texas applies mass production principles to agriculture

. . . Growing
. . . Building

a long season of winter and summer concerts, broadcasts, "pops," and special programs.

The tallest monument in the country (Houston's superlatives are contagious), a 570-foot shaft surmounted by a 35-foot star weighing 220 tons, commemorates the significant battle of San Jacinto and forms the focal point of the 460-acre state park in which it stands.

In keeping with their mild southern climate, Houstonians dress casually, enjoy facilities for year-round golf, tennis, horseback riding, beach bathing, sailing and fishing.

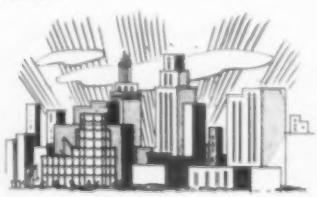
Most pretentious of its beautiful residential sections is aristocratic River Oaks, Houston's Gold Coast. Here in cypress shaded, plantation type homes and mansions of other architectural influences live Houston's tycoons and socialites.

During March, gardens and homes on some of these estates are opened to the public for the Annual Azalea Trail. The fringy, clustered blossoms, ranging through the rose-pink, red and purple shades to white, yellow and orange, are complemented with dogwood, spirea, magnolia, roses, wisteria, quince, Dutch iris, tulips and other bulbs. Statuary, fountains, grillwork, gates, walls and other formal garden features accent the floral displays. (A private tour of two of these estates is being planned for ladies attending the ASTE convention.)

In the new civic center is the Sam Houston Coliseum where the Houston Fat Stock Show and Livestock Exposition is held, the City Hall with its attractive offices, gardens and reflecting pool, and Music Hall, home of the Symphony. To further beautify itself, Houston has launched a $77,000,000 program of civic improvements.

Already in the early stages of construction is the gigantic $100,000,000 Texas Medical Center. This great concentration of medical treatment, training and research institutions will bring together four great universities, a dozen or more independent hospitals and several research institutions on a 163-acre tract of beautiful parkland within the city. The huge Mecca of medicine will be dedicated to the science of better living for Houston and all Texas.

Houston is fitting itself for its splendid future.



▲ Between two spherical tanks, rise the silvery fractionation towers of the nation's largest oil refinery, the Humble Oil & Refining Company's plant on the Houston Ship Channel. Houston has more oil companies and industries allied with petroleum than any city in the world

Rice Hotel, the ASTE convention headquarters, rests on the site of a former capitol of Texas. Big hostelry is part of extensive real estate holdings of former Commerce Secy. Jesse Jones ▶

Fifty miles inland, Houston made itself the second largest U. S. port in deep sea tonnage, by digging a ship channel to the Gulf. In the background is the Turning Basin. Industries valued at more than $600,000,000 line waterway ▶

Administration Building of Rice Institute, Houston's oldest institution of higher learning, is situated on a 300-acre campus among laboratory, lecture and residential buildings of extraordinary beauty. Curriculum includes engineering ▶

Gen. Sam Houston, rallying his followers to victory in the battle of San Jacinto, is memorialized in bronze in the city named in his honor ▶

In March, masses of fragrant azaleas and other spring flowers brighten the grounds of palatial River Oaks estates. Ladies in the ASTE party will be guests for a tour of two of the gardens ▼

Chemical plants, with a bewildering network of pipes, towers and tanks, convert oil, natural gas, sulphur and oyster shell into new compounds

The backbreaking task of hand gathering gives way to the mechanical picker on prosperous plantations around Houston, leading cotton market

Vessels, plying the seven seas, call at Houston's busy port to carry its goods around the world. Oil and grain are being taken aboard these ships

A lonely sentinel, this 570-foot monument, guarding the battleground of San Jacinto, is a landmark for miles around on the flat Texas prairie

. . . See Texas, New Orleans and Mexico, too

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WITH STOPOVERS, optional returns and sidetrips available, the Houston convention affords a rare opportunity for a pleasant family vacation tour of this biggest and somewhat reluctant state of the Union, a jaunt south to leisurely Mexico, or a look-see at romantic New Orleans, due east.

Some 7,000,000 Texans rattle around in their more than 267,000 square miles. Most of the 90 per cent of Lone Star Staters outside Houston make up such communities as the twin ASTE cities, Dallas and Forth Worth; charming San Antonio with its sacred Alamo; Austin, the capital; Galveston, Corpus Christi, Port Arthur and Beaumont in the Gulf Coast area; and the border towns of Brownsville, Laredo and El Paso in the Rio Grande Valley.

Only credentials required to visit our neighbors south of the border are a tourist card and a birth certificate. English is widely spoken in tourist centers such as Mexico City, Monterrey and Acapulco, and there are few obstacles of language or custom that cannot be hurdled with a Spanish pocket dictionary and occasional applications of *la mordida* to itching palms.

But exotic, old world atmosphere can be found within our own boundaries at New Orleans where, in the Vieux Carre, or old French Quarter, balconied structures adorned with delicate iron traceries contrast sharply with the modern skyscrapers of the great port city of the Mississippi, only a block away.

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1. In the heart of San Antonio is the sacred Alamo where 187 heroes gave their lives in defense of Texas liberty. 2. A balcony of the Municipal Palace frames Mexico City Cathedral. 3. Sailing is year-round sport on Galveston Bay. 4. Lacy iron fretwork lends Old World charm to New Orleans' Vieux Carre. 5. These catalytic cracking units are part of the Port Arthur refinery of The Texas Co. 6. Dating from the early 18th century, Mission Concepcion is one of four old missions in San Antonio. 7. Acapulco, on the west coast, is Mexico's fashionable resort. Sailfish abound in these waters

Below, left: Flower venders ply their trade on the canals of the Floating Gardens of Xochimilco near Mexico City. Center: Haggling for a better price is fun for both buyer and seller in native Mexican markets. Right: Monte Alban ruins, near Oaxaca in southern Mexico, are archaelogical riddle

... And Warmly Thank

Fifteenth Annual Meeting Committees

Program Committee

Chairman Natl. Program Com.

H. D. Hall

2nd V. Chairman Natl. Program Com.

E. W. Baumgardner

Secretary Natl. Program Com.

Stephen Urban

1st V. Chairman Natl. Program Com.

R. W. Ford

National Program Committee

F. J. Schmitt

Chairman National Education Com.

O. W. Winter

Natl. Program Com.

F. E. Doty, Jr.

Natl. Program Com.

H. E. Linsley

Host Chapter Committees

Chairman Budget

T. J. Gilchrist

Chairman Entertainment

D. C. Crowley

Chairman Transportation

D. F. Saurenman

Chairman Reservations

W. L. Clark

Chairman Meeting Arrangements

P. E. Brainard

Chairman Notices and Announcements

C. A. Vogt

Chairman Film Arrangements

D. E. Mackenzie

Chairman Editorial

I. W. Barker

Chairman Registration

I. P. Robinson

Chairman Emergency

J. A. Door

Plant Tours

L. M. Cole

Executive

H. E. Collins

Program

Homer Briggs

Meeting Arrangements

J. D. Bailleres

Emergency

G. J. Gilbert

Editorial

R. E. Schuller

Film Arrangements

C. E. Barton

Taking their places at the speakers' table for chartering ceremonies of Madison Chapter, December 17, are, left to right: J. L. Piekarski, Treasurer; Robert H. Bruce, Secretary; E. B. Sperry, Second Vice-Chairman; L. A. Leifer, First Vice-Chairman; A. E. Rylander, Technical Editor, *The Tool Engineer*, and guest speaker; F. H. Kessenich, Chairman; W. B. Peirce, First Vice-President; R. B. Douglas, National Secretary; H. E. Conrad, Executive Secretary; E. W. Dickett, National Membership Chairman; L. J. Radermacher, former Director; and R. H. Ford, Chairman of Milwaukee Chapter

Seventy-fifth Chapter Chartered at Madison

Madison, Wis.—With the chartering of a group of 84 members, December 17, ASTE ended 1946 with 75 Chapters established in as many industrial centers during its 14 years of existence.

W. B. Peirce, First Vice-President of the Society, presented the charter and installed the executives of the new Madison Chapter, in the presence of 96 members and guests attending the dinner function at the Park Hotel.

Officers elected by the membership and sworn in by Mr. Peirce are: Chairman, Fred H. Kessenich, President, F. H. Kessenich Co.; First Vice-Chairman, Lorenz A. Leifer, Assistant Chief Engineer, and Secretary, Robert H. Bruce, Sales Engineer, Gisholt Machine Co.; Second Vice-Chairman, Edward B. Sperry, Chief Engineer, Moe Bros. Mfg. Co.; and Treasurer, J. L. Piekarski, Chief Draftsman, Parker Pen Co.

Others who spoke, welcoming the new Chapter into the Society, included: R. B. Douglas, National Secretary; H. E. Conrad, Executive Secretary; E. W. Dickett, National Membership Chairman; Richard H. Ford, Chairman of Milwaukee Chapter, and L. J. Radermacher of Milwaukee, a former Director.

Guest speaker for the occasion was A. E. Rylander, Technical Editor of *The Tool Engineer*. Reminiscing briefly on the early days of tool engineering, Mr. Rylander presented some practical, down-to-earth philosophy for engineers.

He urged leadership on the part of tool engineers in creating a clearer understanding of international and domestic problems. Prejudice of isms and ideologies should not be permitted to obscure the good qualities of innately friendly people who, in many instances, have had to subscribe to such doctrines against their will, he cautioned.

Situation Wanted

SALES ENGINEERING OR PURCHASING connection sought by engineer experienced in sales and service, buying, production—material control, cost estimating, job evaluation; operations—time, machining, some design experience; and procedure. Address replies to Box 107, American Society of Tool Engineers, 1666 Penobscot Building, Detroit 26, Mich.

Waindle Presented Award For Elgin Achievement

Aurora, Ill.—Roger F. Waindle, General Manager of the Sapphire Products Div., Elgin National Watch Co., has received, on behalf of his company, the 1946 Achievement Award for "the greatest achievement in applying war-born knowledge of materials and their processing to the manufacture of peacetime products."

R. F. Waindle

Reinhold Publishing Corp., originator of the award, pointed out in its notification to the Elgin National Watch division that it was the largest plant to undertake the wartime manufacture of sapphire jewel bearings.

Mr. Waindle, who accepted the award at Atlantic City, has frequently lectured before ASTE Chapters, on engineering applications of sapphire.

He is Constitution and By-Laws Chairman of Fox River Valley Chapter, ASTE.

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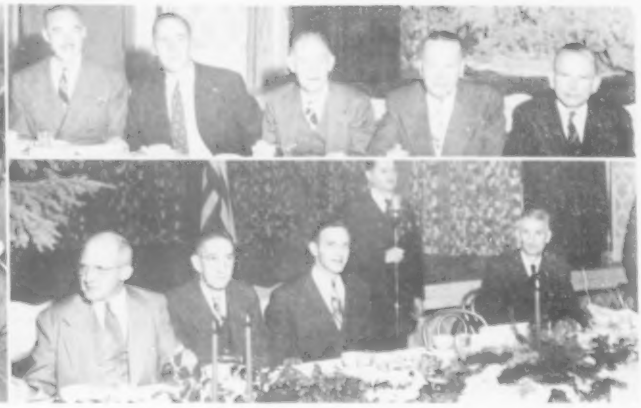
Santa Fills Yule Stockings for St. Louis Guests

St. Louis Chapter guests show their Christmas stockings distributed by Santa Claus at group's ninth annual holiday party and dance, Dec. 13, in the Coronado Hotel. Two hundred and seventy-nine members and their ladies enjoyed floor show and dancing arranged by Entertainment Comm. headed by James Miller. Chapter presented several hundred dollars worth of toys to Salvation Army, for underprivileged children



Photos courtesy Western Machinery and Steel World

Left: This group (foreground) from Naval Air Station, Alameda, Calif., helped swell attendance at Golden Gate's Christmas party. At speakers' table are (top): Jack Lee, E. C. Holden, 2nd V. Chm.; Fred Martens, Ticket Chm.; Walter Gustafson, former 2nd V. Chm.; DeWitt M. Grimm, Entertainment Chm.; (below): K. L. Bues, Past Chm.; Lester Martin, Membership Chm.; F. V. Snodgrass, 1st V. Chm.; E. J. Raves, Chm.; and Carl Horack, Past Chm.

Sundstrom Details Plastics Processing

Providence, R. I.—At a dinner meeting of Little Rhody Chapter, held November 20 in Oates Tavern, C. A. Sundstrom, Project Engineer, General Electric Co., Pittsfield, Mass., described methods of plastic molding, giving many illustrations of proper design of product and tools for reducing molding cost.

C. A. Sundstrom

Preceding his talk, a sound motion picture, "Plastics at Work," was shown. Samples of plastic articles were displayed for inspection. An interesting question and answer period followed the address.

Wilfred Pender, Second Vice-Chairman, was appointed delegate to the Annual Convention of the New England Council in Boston, Mass., the second to be co-sponsored by the Chapter.

Announcement was made that the Chapter Education Committee and Lloyd A. Sheeran, of the National Education Committee, are working with Rhode Island State College in preliminary plans for tool engineering courses.

Ninety-five members and guests were present.

Gruber, Vice-President of Brown & Bigelow

St. Paul, Minn.—F. E. Gruber has been named Vice-President in Charge of the Mechanical Div. of Brown & Bigelow, according to an announcement by Charles A. Ward, President.

F. E. Gruber

Mr. Gruber is a graduate of Valparaiso University, Valparaiso, Ind., and went to Brown & Bigelow from the Western Electric Co. in 1933. The following year he became Superintendent of the Machine Shop and Tool Room, having charge of all machine building and tool designing for the company's products. Early in 1943 he was made Director of War Production.

Mr. Gruber has served two terms as Chairman of Twin City Chapter, ASTE.

Navy Velocity Power Tools Adapted to Industry

Pittsburgh, Pa.—N. R. Chillingsworth, Advertising Manager of the Mine Safety Appliances Co., Pittsburgh, presented a convincing demonstration and talk on velocity power tools, before nearly 100 members of Pittsburgh Chapter at their November meeting.

These tools, Mr. Chillingsworth explained, utilize in a highly efficient manner the energy generated by burning powder. With them it is possible to swedge cable, knock out 1" rivets, punch holes in steel plates or drive studs into heavy plates.

Light in weight and portable, they eliminate the need of heavy equipment for emergency repairs in the field. Their mobility, simplicity and speed of operation are outstanding features.

In the demonstration, an electric cable splicer, weighing only six pounds, joined the ends of a No. 1 single conductor flexible trailing cable as encountered in mining operations, and a punching tool, weighing 27 pounds, made a clean hole 13/16" in diameter through a 1/2" plate.

Another demonstration showed an 18-lb. driver forcing a 1/2" prethreaded stud through a 1/2" plate.

These tools illustrate the principles developed for the Navy Department during the war and now being adapted for industrial applications.

Mr. Chillingsworth also demonstrated the M.S.A. Redi-Heat block, heated by means of a replaceable cartridge and designed to safely supply heat under field conditions, and the Chemox self-generating oxygen apparatus and equipment designed for person and plant protection.

The speaker was assisted by E. W. Gilliland, K. L. Steele, George W. Morse and C. Sanderson, all of the Mine Safety Appliances Co.

Holiday Stag

San Francisco, Calif.—More than 500 members and guests of Golden Gate Chapter turned out December 13 to exchange season's greetings, dine, relax and enjoy the excellent floor show presented at the annual Christmas party, held in the Claremont Hotel, Berkeley.

Former Chapter Chairmen welcomed to the speakers' table by Chairman Edward J. Raves included: Carl Horack, Karl L. Bues, Louis Talamini and Harold Wolpman.

Among the larger groups attending the affair were delegations from the Naval Air Station, Alameda; Schlage Lock Co., San Francisco; Grove Regulator Co., Emeryville; and the Joshua Hendy Iron Works of Sunnyvale, Calif.

Baltimore Members Hosts for Annual Dance

Two hundred and fifty couples step to the music of Billy Isaacs' "Commanders," with occasional vocalizing by George J. Stevens, Entertainment Chm., at Baltimore Chapter's recent dance in Hotel Emerson

Strolling accordionists added to gaiety of Flint Chapter's first Christmas party, December 12, at Fischer's Hotel in Frankenmuth, Mich. Festivities included dinner, group singing, floor show, favors and prizes

Plants Show Metal Cutting, Aircraft Research

Cleveland, Ohio—A record turnout of approximately 300 Cleveland members participated in a tour of the Warner & Swasey plant, November 8.

Dinner at the plant preceded a slide-illustrated talk by J. F. Allen of the company's metal cutting research laboratories. Mr. Allen described many of the odd effects and difficulties experienced in the use of carbide tooling under high production speeds and feeds. His talk also demonstrated some of the shortcomings of carbide tooling and the remedies indicated in each instance.

After the technical lecture, Walter K. Bailey, Executive Vice-President of Warner & Swasey, welcomed the engineers, advising them what to look for in their inspection of the factory. The tour was made in small groups, conducted by guides who answered the visitors' questions.

Highlights of the trip included latest developments in metal cutting, revolutionary earth moving equipment, and the assembly of five-spindle automatic screw machines, as well as turret lathes in process of manufacture.

* * *

In another trip to the huge Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics at Cleveland Airport, the members saw recent technological developments of the air forces in all types of aircraft research, including jet propulsion.

* * *

Russell Bradshaw and Gordon Thayer of the Plastics Development Div., Dow Chemical Co., Midland, Mich., addressed an earlier joint meeting of the ASTE group and the Society of Plastics Engineers.

Their talks were co-ordinated to give both groups an understanding of the relation of good mold design to efficient plastics production.

Mr. Bradshaw's portion of the session was based on experience gained in on-the-job solutions of plastics production problems encountered in mold shops distributed over a wide area and producing an equally wide variety of products.

Mr. Thayer's discussion included techniques developed in the Dow laboratory at Midland, to correct these difficulties.

"The Shape of Things to Come," a sound-color film, showed procedures in modern plastics molding.

It's Later Than You Think For Making Your Houston Hotel Reservation

Camera Catches Motor City Members in Holiday Mood

These festive Detroiters were part of group of 550 members and guests attending their Chapter's Christmas party in the Book-Cadillac Hotel, Dec. 10. Robert D. Seeley led group singing which followed dinner. Three-hour program of professional entertainment, orchestra, and awarding of prizes completed evening

248 Merrymakers Attend First Christmas Party

Flint, Mich.—Flint Chapter took time out to play at its first annual Christmas party, held December 12 at Fischer's Hotel in Frankenmuth. Two hundred and forty-eight members and their wives filled the large ballroom for dinner and the sparkling show which followed.

Chapter Chairman L. A. Kitchen opened the meeting with a genial welcome to the ladies, explaining the purpose of ASTE and Flint Chapter. He was followed by Harlan T. Pierpont, Second Vice-Chairman, who led the group in singing Christmas songs. Mr. Kitchen then introduced the master of ceremonies, C. L. Bendle, a Chapter member, who presented other Chapter officers and described their responsibilities.

After distributing gifts and amusing novelties and entertaining with feats of magic, Mr. Bendle introduced "Jessica" and her company. The quick-witted, fast-talking mistress of ceremonies presented "Carol" in a controlled acrobatic dance and "Chicita" and her puppets.

McDonald Opens Engineering Service

Evansville, Ind.—Earl E. McDonald has recently organized the McDonald Engineering Co., specializing in die casting and injection plastic mold design, tools and dies, jigs, fixtures and special machine design in production setups.

E. E. McDonald

During the war years, he was Design Engineer at Higgins Aircraft in New Orleans, later moving to Evansville to be Chief Engineer and Mold Designer for a tool and die company. Prior to opening his own business, he was associated with a Chicago designer.

Mr. McDonald is a member of Evansville Chapter, ASTE.

Situations Wanted

MACHINERY and EQUIPMENT ENGINEER—14 years' experience, including supervision of equipment, machinery and related tools for sheet metal work and metal processing. Has practical knowledge of machine tools, production planning, tool design, procurement, application, installation, plant layout, and maintenance, for efficient production. Member ASTE. Write Box 109, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

MANUFACTURING EXECUTIVE—Graduate engineer, 37, with thorough management and manufacturing background in metal fabrication industry. Detailed in tool engineering, production control; plant, welding and industrial engineering; factory cost, purchasing, sales, development, research and labor relations. Invites correspondence for position as Works Manager, Assistant to General Manager or President, or Executive Technical Director. Address: Box 108, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

ASTE-ASA Move Toward Program Cooperation

Detroit, Mich.—Cooperation in the respective standardization programs of ASTE and ASA was the subject of a meeting of the ASTE National Standards Committee held in Detroit, December 11. Dr. John Gaillard of the American Standards Association was guest of honor and principal speaker.

During the four-hour session, Dr. Gaillard was literally bombarded with questions ranging from, "What benefits does ASTE derive from its membership in ASA?" to "What part does ASA play in actual standardization work?" One of the main queries entertained at the meeting was, "What would be the most efficient setup for both ASTE and ASA relative to our own standardization program?"

These were but a few of the questions asked Dr. Gaillard, who is considered by industry to be one of the most astute minds engaged in standardization activities.

In thanking Dr. Gaillard for participating in what he termed one of the most successful meetings of its kind ever held in the Society's 15-year history, W. H. Smila, ASTE Standards Chairman, said, "Much has been gained here that will further cement the work being done by these two important groups into a unified and concerted program that will serve industry and engineers well in the years of unprecedented competition that lie ahead."

Among participants at this meeting was I. F. Holland, ASTE Second Vice-President, who made a special trip from Hartford, Conn., to join in the discussion which he said will have much to do with further development of ASTE as an important international engineering society.

Christmas Fun Night

Philadelphia, Pa.—Three hundred and forty Philadelphia members enjoyed an evening of good fellowship and relaxation when the Chapter staged its annual Christmas party December 19 at the Engineers Club.

The dinner party was under the direction of Joseph P. Danihel, Jr., assisted by Thomas J. Donovan, Jr., who secured as master of ceremonies "Sandy" MacIntosh, a comedian in the best Scotch manner and for 20 years Foundry Superintendent at Wright Aeronautical Corp., Paterson, N. J.

Harry Taylor, in charge of the entertainment, presented several acts, including the Ripley "Believe It or Not" cornetist who plays three of the instruments simultaneously.

A number of attractive prizes, including a radio and a turkey, were awarded during the evening.

Larson Joins Bausch

Springfield, Mass.—Edwin L. Larson has resigned his position as Field Engineer for F. H. Robertson Co., Malden, to accept the post of Chief Engineer at the Bausch Machine Tool Co., Springfield, manufacturers of heavy automatic machine tools.

In returning to the Bausch company, Mr. Larson resumes an earlier association. During World War I, he served in the U. S. Navy as Asst. Machinist Mate 1/C.

He is Membership Chairman of Springfield Chapter, ASTE.

Worcester Has Christmas Get-Together

Worcester Chapter observed the holiday season with its annual Christmas party, held at Putnam & Thurston's Restaurant, Dec. 3. Social hour, with 173 members and guests participating, preceded dinner. Orchestra entertained during meal, accompanied subsequent floor show. Gifts were distributed to everyone present. At speakers' table, top left to right, are: Charles Monigle, First Vice-Chairman; Henry Wilder, Past Chairman; Curtis Pardee, Standards Chairman; Harold Thompson, Treasurer; George Degon, Secretary; Albert Warman, Chairman; Victor Ericson, National Treasurer; Robert Lippard and Ray Morris, Past Presidents; John Lindegren, National Membership Committee; and Carroll Morse, Entertainment Chmn. of the Chapter

Reveals Difficulties In Tooling 'Sparklets'

St. Louis, Mo.—Complications in tooling and filling Sparklet bulbs and containers were very effectively presented to St. Louis Chapter by H. F. Tomasek, Chief Engineer of Sparklet Devices, Inc., Div. of Knapp-Monarch Co., St. Louis, and a charter member of the Chapter.

Mr. Tomasek was the technical speaker at a dinner meeting November 7 in the Melbourne Hotel. The meeting, designated "Second Vice-Chairman Night," was conducted by Harrel Creasey who holds this office.

The speaker presented a color film showing all production operations from blanking and cupping, through drawing of the case, to finished bulbs, and the filling of the bulbs with various gases and liquids.

Machining operations, tooling for the extreme pressure present in the bulb and sealing the bulbs to prevent leakage over a long period of time, constituted major tool engineering problems.

In outlining the history of carbonated gases, Mr. Tomasek went back to the time of Pliny, in the days of St. Paul, then on through the 16th century when Val Helmont produced gas carbonum, to Priestly's discovery of oxygen, with the study of CO_2, all leading to gas containers. The records indicate that the first such application of carbonated gases was during the reign of Queen Victoria.

At the beginning of the war, Sparklet bulbs were enlisted by the joint Army and Navy Board to enable each serviceman to wear a life preserver, resulting in the saving of many lives through the agency of a $2\frac{1}{2}$" long bulb.

Mr. Tomasek then related the development of the Aerosol bulb used by the Armed Forces to kill disease-bearing insects and make life more comfortable in jungles and swamps.

Prior to the technical session, Vincent Ring gave an after-dinner talk on the American incentive system.

This duo-cornet team was one of the diversions at Dec. 19 Christmas party Philadelphia Chapter held in the Engineers Club. Below: Audience chuckles at a solly by "Sandy" MacIntosh, master of ceremonies

Coming MEETINGS

ALL CHAPTERS—February. Election of Chapter Officers, Delegates and Alternates. March. Installation of officers.

BOSTON — February 13, 6:30 P.M., Schrafft's Restaurant. Speaker: C. E. Stubbs, Senior Partner, Henry A. Loudon, Advertising, Boston, Mass. Subject: "Why Should Industrial Design Interest the Tool Engineer?"

CINCINNATI—March 11, 6:30 P.M., Cincinnati Engineering Society. Speaker: Fr. Steckschulte, Xavier University, Cincinnati. Subject: "Seismology."

CLEVELAND—National President's Night, honoring A. M. Sargent. Speaker: James Y. Scott, President, Van Norman Co., Springfield, Mass. March 14. Plant tour through White Motor Co. Dinner at plant followed by address by company official and tour.

DAYTON—March 10. Plant visitation to Master Electric Co., Dayton, Ohio. Dinner, 6:30 P.M.

DETROIT—February 13, Engineering Society of Detroit. Speaker: Harry Coopland, Special Representative, Jack & Heintz, Inc., Cleveland, Ohio. Subject: "Seeing Is Believing." N. L. Bean, Asst. Production Engineer, Ford Motor Co., will discuss the Ford Company's contribution to tool engineering. March 13, Industrial Executives Night. Speaker: Guy Hubbard, Machine Tool Editor, *Steel*, Cleveland, Ohio. An address on the history of the machine tool industry. March 25. Special meeting in conjunction with Specialist Program of Affiliated Council of the Engineering Society of Detroit. Speaker: Prof. O. W. Boston, University of Michigan, Ann Arbor, Mich. Subject: "Problems Associated with Metal Cutting, Cutting Tools, Material Cut, Cutting Fluids."

ELMIRA—March 3, 7:00 P.M., Mark Twain Hotel. Speakers: Prof. Donald Shank, Director of Student Personnel and head of School for Industrial and Labor Relations; Prof. M. F. Neufeld, Secy., School for Industrial and Labor Relations; and Prof. J. C. McConnell, Professor of Human Relations, Cornell University, Ithaca, N. Y. Subject: "Purposes and Progress of the Cornell School for Industrial and Labor Relations."

ERIE—March 4. Program to be sponsored by the Doehler Die Casting Div. of Doehler-Jarvis Corp.

FLINT—February 20. Subject: "A New Concept of Mass Production." March 20. Subject: "Cutting Oils and Drawing Compounds."

HAMILTON — February 14, 7:00 P.M., Kirby House, Brantford, Ont. Speaker: H. B. Chambers, Chief Metallurgist, Atlas Steels, Ltd., Welland, Ont. Subject: "Tool Steels for Blanking and Forming." March 14, 7:00 P.M., Fischer's Hotel, Hamilton. Speaker: A. E. R. Turner, Vice-Pres. in Charge of Sales, John Bertram Co., Ltd., Dundas, Ont. Subject: "Machine Tools of Today."

HOUSTON — March 19-22, Rice Hotel, 15th Annual Meeting, ASTE. March 20, House of Delegates Meeting. March 20-21, Board of Directors Meeting.

LITTLE RHODY — February 19, Oates Tavern. Speaker: A. H. Moore. Subject: "Electronics." March 19. Speaker: R. E. Hamilton, Aluminum Session.

MILWAUKEE — February 13. Speaker from George Gorton Machine Co., Racine, Wis. Subject: "Exact Duplicate." March 13. Speaker from Haynes-Stellite Co., Chicago, Ill. Subject: "Selection of Hard-Facing Materials and Methods."

NASHVILLE—February. Subject: "Tooling and Costs." March. Subject: "Induction Heating."

NEW HAVEN—February 13, 8:00 P.M., Dunham Laboratory, Yale University. Speaker: Z. C. Van Schwartz, Chief of Machine and Research Div., Peck, Stow & Wilcox Co., Southington, Conn. Subject: "High Speed and High Cycle Milling." March 13, Executives Night, 6:30 P.M., Seven Gables Towne House. Speaker: A. S. Redway, Vice-Pres. and Gen. Mgr., Geometric Tool Co., New Haven, Conn. Subject: "Relationship Between Management and the Tool Engineer."

PHILADELPHIA — February 20. Brill Night. Speaker: C. H. Hopper, Gen. Supt., J. G. Brill Co., Philadelphia, Pa. Subject: "Competitive Motor Coach Manufacture." March 20. "Quiz Masters" and "Doctor I.Q."

SYRACUSE—March 11, 8:00 P.M., Onondaga Hotel. Speaker: Larry W. Lang, President, Larry W. Lang Co. Subject: "Cutting Tool Reconditioning."

TOLEDO—March 12. Dinner, 7:00 P.M., Commodore Perry Hotel. Speaker to be announced.

TORONTO — March 10. Speaker: Clare Bryan, Consulting Tool Engineer, Link-Belt Co., Chicago, Ill. Subject: "Practical Engineering of Jigs and Fixtures."

Production Press Work First Technical Topic

Poughkeepsie, N. Y.—Herman F. Zorn, President of the V & O Press Co., Hudson, N. Y., was guest speaker at the December 4 meeting of Mid-Hudson Chapter. This first technical session of the recently chartered group was enjoyed by an attendance of 95 members.

H. F. Zorn

Mr. Zorn's lecture, "Presses Geared for High Speed Production," was augmented with motion pictures and an interesting display of sample parts.

An amusing diversion was provided by several of Mr. Zorn's associates, adept in attaching pencils to coat lapels by means of string loops. Technical problem was to detach the pencil without cutting string or buttonhole.

The technical session was preceded by dinner, and group singing led by Floyd Billings at the piano.

Magicians Entertain At Ladies Night

Rockford, Ill.—Ladies Night was observed by Rockford Chapter at their meeting December 13 in the Faust Hotel.

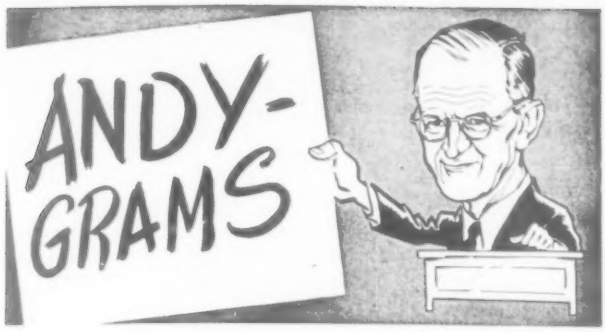
Amid festive decoration in the Christmas motif, which included corsages for the women guests, approximately 70 couples danced to a string quartet and enjoyed a holiday dinner.

Chairman Don Hawkinson introduced the Magical Wurtzels who furnished an hour's entertainment of mystifying tricks accompanied with laughter-provoking fun.

Several members of the audience who assisted the magicians in their acts were rewarded with small prizes.

Boston Chapter Members See 600 MPH Jet Propelled Engine

At left, R. G. Standerwick, Engineer, Aircraft Gas Turbine Div., General Electric Co., River Works, West Lynn, Mass., and principal speaker at Boston Chapter's recent visit to the plant, explains construction and operation of an aircraft supercharger. Left to right: R. C. Robin, Engineer, A.G.T. Div., G.E.; Mr. Standerwick; J. B. Savits, Chm., Boston Chapter; E. E. Stoeckly, another G.E. speaker on program; and W. W. Young, 2nd V.-Chm. of Boston Chapter. Center: Howard Dennis, son of a Boston member, accepts original framed drawing of P-80 jet propelled "Shooting Star," from J. X. Ryneska, Chapter 1st V.-Chm. Howard won drawing at lottery participated in by boy guests. Right: Another group listens to description of operation of TG-180, fastest jet propulsion engine. Model, with unofficial speed record of 619 mph, will be used next summer to establish world speed record



With this issue, the reborn The Tool Engineer enters into its third year. And now, as the Walrus said, we "may talk of many things"—or as much as I've space for on one page. For one thing, two years of publication by the Society has definitely proven that, contrary to a more or less prevalent belief, tool engineers can put out a magazine and project it into the first division in the technical publications field.

In this connection, a letter from our up 'n' coming Nat'l Treasurer, Vic Ericson, is particularly pat. I quote in gist.

"Dear Andy:

I had occasion to call on a concern (a T. E. advertiser) and the owner mentioned . . . something that made me very proud. A solicitor from another publication had remarked that 'those boys did something that has never been done before . . . they started out entirely ignorant of the publishing game . . . many anticipated that they would lose their proverbial shirt . . . and also lose face . . . they accomplished the impossible and have come out with a high-grade magazine worthy of the name . . . it is now one of the top publications.'

". . . . any time you feel low, Andy, just take a trip to one of the meetings and hear what they say about the Magazine.

Vic"

Thanks, Vic—and your letter is hereby acknowledged. And thanks to our unnamed competitor(?) for them kind words. At that, the job wasn't so tough considering that tool engineers have a rep for doing the impossible. Besides, we weren't entirely ignorant of the publishing game although what we didn't know proved to be a blessing in disguise. Disregarding tradition, as the Society did at its inception, we sensed the needs of our field and presented a "new" among technical publications.

THE FIFTEENTH ANNUAL MEETING, MARCH 19 TO 22

Speaking for myself, the transition to technical editor was ducksoup. They pushed me off the dock, so to say, and once in the drink I had to swim or sink. Too busy to worry about ignorance. At that, 'twarn't nothing to it. All I had to do was to buy one of these 5c Blue Books* on proof reading, convert picas to decimal fractions—1 pica = .16666"—and the rest was just a matter of elementary arithmetic and a lot of help from the typographers and compositors whom I've found to be regular guys.

Of course, I had a smattering of basic English (you need that to be an editor) and a general idea of tool engineering a/c having run a drill press back in '02—and oh yes, a spinning mule in '99!—besides which I'd made a drawing or two along with some figgering of triangles. Nope, I wasn't entirely ignorant, nohow.

Y'know, a lot of things come to mind when reviewing the "first hundred years." In my naivete—and perhaps because of an innate liking for people—I'd assumed that there would be the same friendly rivalry in the publications field that one usually finds in industry. So, on and off during the ten years of writing the Column in the old *The Tool Engineer*, I'd mention various editors and field men with other trade publications. But somehow, their names never appeared in print—a result, as it was explained, of a "typographical error." Besides, I was told, it just wasn't done. We'd be advertising competitors, and they'd just laugh at us.

Well, maybe. But since we've been publishing the new The Tool Engineer I've been mentioning these rival(?) editors as we've met in our travels (they're people too, y'know) and so far, I've no recollection of any of 'em laughing at us. With us, yes, which is something else again. And, several leading editors have contributed articles to The Tool Engineer, even as competitors—to use that term—have reprinted articles that first appeared in our pages.

Now, neither the Society nor its official publication concedes any competition, other than friendly rivalry or emulation, with other technical groups or publications. We have a common purpose, and that is to promote technical knowledge and to serve industry. And because the A.S.T.E. is a friendly Society, and The Tool Engineer a friendly magazine, we win friends. Life's like that.

GET SET, NOW, TO MEET US IN HOUSTON COME NEXT MONTH

From John Sylvester, Boston, a clipping from the *Boston Herald* about a monkey, that got loose in a Detroit street car, all illustrated by cartoonist Dahl. Thanks, John, for putting me hep to local news. From Bill Young, a hint to drop in on the boys when next in the Hub. Well, I may trek down from Montreal, via Springfield, Vt., in a roundabout way ere long, having several errands around New England besides some in the middle west that've been long deferred. As aforesaid, I should have been twins—or better still, triplets.

SPECIAL TRAINS, CHICAGO AND ST. LOUIS TO HOUSTON

Speaking of letters, one came in from an ex-G. I. who's been making the rounds of various colleges trying to find one where he can learn tool engineering. Seems none of 'em had any idea what tool engineering means. Sez he: "I don't want to spend years learning to design steam boilers . . . if you do not know what constitutes a course in Tool Engineering there is no use looking any farther." Well, I gave him names of a few institutions of learning that might meet his wants, and I hope he's set by now. Trouble is that tool engineering takes in so much territory, steam boiler manufacture included, that it's hard to be specific. The world's our oyster.

I'LL BE LOOKING FOR YOU IN HOUSTON.

Since writing the above, I've gotten more info about that monkey, and it's quite a story. Seems he chased all the passengers out of the car, by token of which I think I'll get me one of those critters—or maybe an alligator—so as to move standees who clutter up the front of a car to the rear. Or is it "step up forward, please"(?) I've forgotten which, not having ridden a street car since I was in Boston last.

Well, that'll be about all for now a/c I want to get started dusting off my chaps and softening my boots with neatsfoot oil for that trek down to Houston next month. Can't come down there looking like a tenderfoot. Wonder what became of the 10 gallon hat I bought in Dallas back in '11? Yessuh, I'll be seein' yo'all at the rodeo and maybe share a snack with yo' at th' chuck wagon.

ASTEely Yours,

Andy

Speaking of Blue Books, did any of you boys get Clete Briner's Christmas card?

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Screw Slotting and Cutting-Off on the Lathe

HEREWITH IS A COMBINATION fixture that can be used both for screw slotting and for cutting-off on the lathe. We have used it for slotting various sizes of screws, and for cutting-off small pins, and in one case adapted it to cutting $\frac{1}{8}$" off a large lot of $\frac{1}{4}$" x 2" carriage bolts.

The fixture (Fig. 1) consists of a piece of steel *A* which can be mounted in place of the tool post. The vertical piece *B* is hinged to *A* by a cross pin *C*. A screw and lock nut *D* will act as a stop, and control depth of cut. At *E* is shown a workpiece in place. For quantity production a hardened bushing should be inserted in *B* to receive the work.

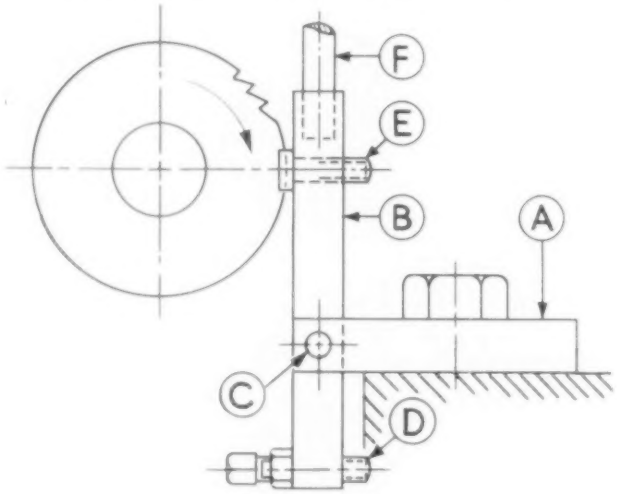


FIG. 1, above.

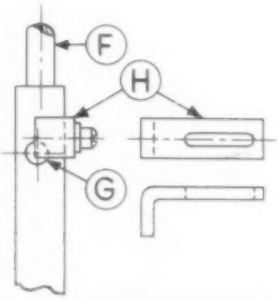


FIG. 2, right.

In operation, work is placed as shown and advanced to saw by means of a handle *F*.

To adapt the fixture to cutting-off, another leaf is made as shown by Fig. 2. Here a hole *G* is drilled and reamed and, for production, bushed with a hardened bushing as a stock guide, and an adjustable stop *H* is provided. Otherwise, the operation is the same as for the screw slotters.

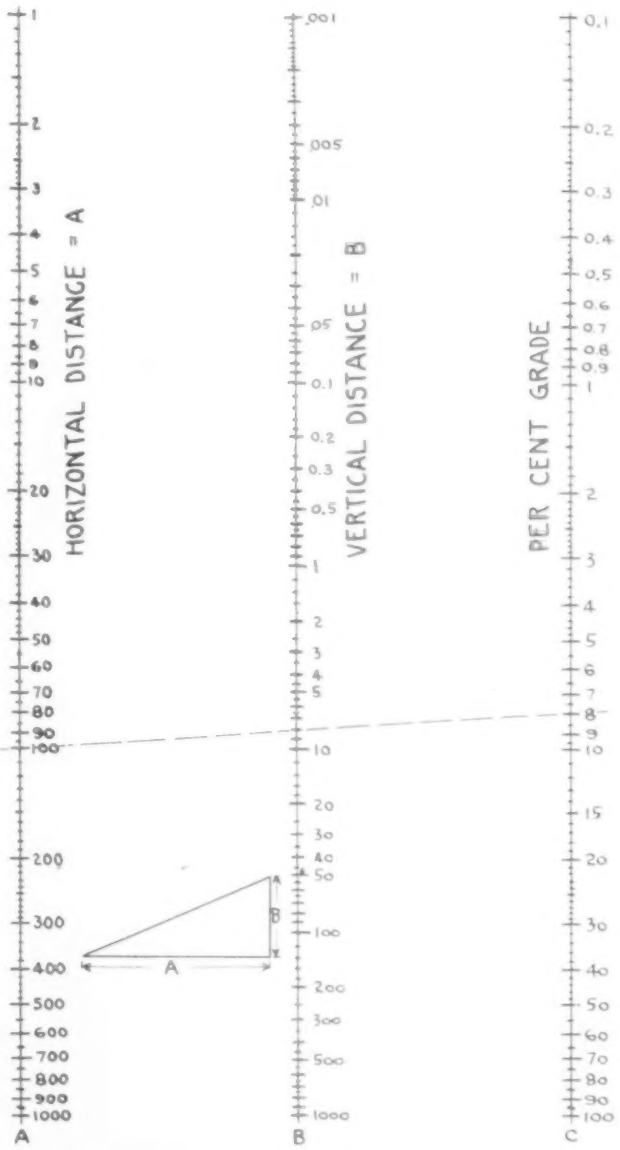
Donald A. Baker,
166 Lake Ave.,
Boonton, N. J.

Chart for Gradients

THIS CHART will instantly give the grade of any road, or the like, without the necessity of doing any figuring. Referring to the sketch drawn on the chart, grade is the height *B* gained after traveling a distance *A*, horizontally, divided by the distance *A*.

Thus, for example, if the vertical distance *B* is 8 feet and the horizontal distance *A* is 100 feet; dividing 8 by 100 we find that the grade is 8 per cent.

To use the chart simply run a straight line through the horizontal distance *A*, column A, and the vertical distance *B*, and the grade is immediately found in column C. The dotted line drawn across this chart shows that where the horizontal distance *A* is 100 ft., column A, and the vertical distance *B* is 8 ft., column B, the grade is 8 per cent, column C.



Column C includes all grades from one-tenth of one per cent to 100 per cent. Therefore the chart will handle most of the grade problems encountered in ordinary practice.

W. F. Schaphorst, M.E.
Newark, N. J.

Plan now to attend the Fifteenth Annual Convention, A.S.T.E., at Houston, Texas, March 19 to 22.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

SHOT PEENING, publishing by *American Wheelabrator & Equipment Corp'n*, Mishawaka, Ind., is a 128-page book giving complete explanation of the process of peening metal surfaces with a rain of metallic shot to improve fatigue life.

Complete with 65 illustrations and charts, the book shows how each round metallic shot, thrown at relatively high velocity at the surface of the metal, acts as a small peen-hammer, "making a small dent," explains the text, "in the surface of the metal and stretching the surface radially as it hits. In some cases, notably high manganese steels, the cold working effect of shot peening has been found to extend as much as .030" and more, depending on intensity, below the surface." Nominally priced at $1.50, the book will be mailed free to interested executives.

NO INFLATION COMING! A new book by William J. Baxter, Director of the International Economic Research Bureau of New York, aims to show, not only the soundness, but the non-inflationary future of the American dollar. The author reveals how financiers and corporate executives of the past have taken advantage of the identical factors in American life that exist right now. Available from the *International Economic Research Bureau*, 76 William St., N. Y. 7, the book is priced at $1.00 per copy.

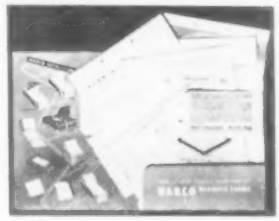
1946 A YEAR OF CALAMITY—Strikes and Material Shortages Hamstring the Automotive Industry, by Leonard Westrate, in December 15th issue, *Automotive & Aviation Industries*, covers the production of cars and trucks, employment, man-hours, payrolls, strikes, shortages, shutdowns, steel shipments and net income. It was considered so noteworthy by the editors of that magazine that they mailed a copy to every Senator and Representative in the new U. S. Congress.

ACTIVE PORTION OF INVOLUTE ON EXTERNAL SPUR AND HELICAL GEARS, by Sidney Cornell, in January *Machinery*, explains that "knowing the active portion of involute gear teeth permits the use of profile recording machines with greater accuracy and with less danger of damage to the instrument." The basic principle of the involute—generated by a fixed point on a taut string as the string is unwound from a pulley—is discussed. Also, the method of determining the used portion of the involute is analyzed and applied to its measurement.

INDUCTION HARDENING OF STEEL, by Dr. D. L. Martin and R. A. Gehr, in January 13th issue of *Steel*, has as its primary thesis that a better understanding of the fundamental factors of induction hardening—power, frequency, coil design, quenching fixture, metallurgical response, and the process itself—will certainly result in "better utilization of equipment and appreciation of potentialities."

This article, the first of a series, traces the phenomena of current induction, which is the basis of induction heating, from the independent discoveries in 1831 by Faraday in England and Henry in America, on up to its present widespread use for hardening of steel parts. Thirteen advantages of induction heating methods and seven limitations are discussed. There are four charts, and also a treatment of several formulas dealing with skin effect and power input into the charge.

UARCO BUSINESS FORMS, prepared by *Systems Dep't, Uarco Inc.*, 5000 S. California, Chicago 32, is a new portfolio of business forms which are now being widely used by machine tool and metal working industries. Copies of the portfolio may be obtained without obligation from the publishers.



PROCEEDINGS OF THE 1946 CONFERENCE OF THE SMOKE PREVENTION ASS'N, available from the publisher, *John Paul Taylor*, 520 Pleasant St., St. Joseph, Michigan, is a book consisting of technical papers by members of the association who are smoke inspectors for various municipalities, and by operating and research engineers concerned with the smokeless burning of fuels. Size 8½ x 11, price $2.00.

ESSENTIALS OF AIR GAGING, by W. Fay Aller, Director of Research, The Sheffield Corp'n, in January 2nd, *American Machinist*, starts with fundamentals, such as this statement: "Essentially air gaging depends upon the flow of air between the faces of jets or specially constructed heads and the part being gaged." This article, the first in a series, then discusses in detail the principle of the mechanical back-pressure air gage wherein back pressure is controlled by the ratio of ortifice to air escaping when the gaging head contacts maximum or minimum part.

A water-column back-pressure air gage is then analyzed; and this is followed by a constant-pressure rate-of-flow air gage which the author explains was developed to overcome limitation of previous types. Lastly, an improved constant-pressure rate-of-flow air gage is included and advantages listed.

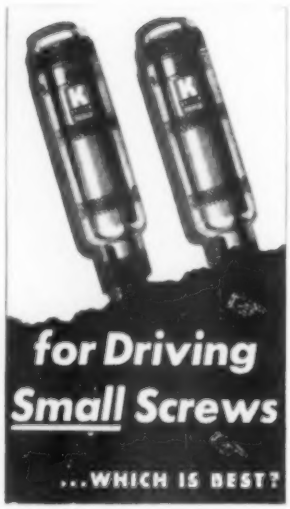
In general, the author concludes that air gages are economical because wear life is long, that in the last few years they have attained an unquestioned accuracy, that they possess an ease of operation allowing lower-skilled operators and inspectors to use them, and one operator may do the work of many by means of multiple applications.

MODERN MATERIALS HANDLING EQUIPMENT SAVES TIME & MONEY, a staff-written article in January *Mill & Factory*, is especially timely in view of the recent Nat'l Materials Handling Exposition, held at Cleveland, January 14-17, and the acknowledged fact that materials handling costs generally account for 20% or more of the final cost of a product.

This article is filled with discussion of a wide assemblage of products. That the materials handling field is broad can be gained by glancing briefly at the various sections of *Mill & Factory's* article. They include shop trucks, with a discussion of same, including power and hand models; pallets, made of wood, aluminum and other metals; overhead cranes and carrier systems; conveyors, in belt and roller forms; hoists and chain blocks, in electric, air, as well as chain types; supplementary materials handling equipment, including steel strapping, truck wheels and casters, boxes and bins and baskets; fiber and wire ropes, and slings; grabs, grips and tongs; and industrial scales.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.



KELLER TOOL CO., Grand Haven, Mich., has a folder, . . . *for Driving Small Screws*, announcing research results on two new power screw drivers. Model 1671, with a free speed of 2,500 rpm, is designed for use with free-running machine screws up to Size No. 3, and for very small self-tapping and wood screws. Model 1672, has a free speed of 10,000 rpm and accommodates screws in the No. 3 to No. 6 range. It is recommended for wood screws, self-tapping screws, and larger machine screws. This tool has no torque adjustment.

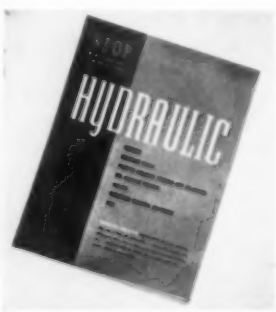
HARDINGE BROTHERS, INC., Elmira, N. Y., has issued *Bulletin GF*, describing a new fixture designed to provide a convenient and accurate means for rapidly sharpening, and checking the sharpening of circular form tools for automatic screw machines and turret lathes. It is called the Hardinge Sharpening & Checking Fixture for Circular Form Tools.

NORTON COMPANY, Worcester 6, Mass., has available a folder, . . . *And Now 32 Alundum*, describing their new type aluminum oxide abrasive, and the stocks of Alundum wheels now available for surface, tool and internal grinding.

CARBOLOY COMPANY, INC., Detroit, has available a booklet, *No. D-120*, describing the versatility of carbide dies, which should prove especially interesting to all connected with the deep drawing of sheet metal.

Revisions of *"Blue Sheets"* containing information about seven alloy steels, and the second edition of *Methods Manual for "Carmet" Carbide Metal Tools*, have just been made available by **ALLEGHENY LUDLUM STEEL CORP'N,** Pittsburgh, Pa.

Felt Facts, a folder available from **KORBEL & COLWELL, INC.,** 480 Lexington Ave., N. Y. 17, defines felt as a "fabric built up by the interlocking of fibres by a suitable combination of mechanical work, chemical action, moisture and heat, without spinning, weaving or knitting." Other technical information includes data on the use of felt for wick lubrication, and for noise and vibration reduction mountings.



Stop Down Time on Hydraulic Equipment, a folder by **HONAN-CRANE CORP'N,** subsidiary of Houdaille-Hershey Corp'n, 676 Wabash St., Lebanon, Ind., discusses types of oil contamination, and explains how Cranite (fuller's earth) and specifications of Honan-Crane Purifiers cut maintenance costs and make for longer pump life.

DETROIT STAMPING CO., Dept. K, 356 Midland Ave., Detroit 3, has available *Catalog No. 47*, containing specifications of their entire clamp line, illustrations of many applications; and also a section on arbor spacers, shims, shim and feeler stock and miscellaneous job stampings data. This catalog on quick acting clamps should prove invaluable to tool engineers and tool designers.

ARO EQUIPMENT CORP'N, Bryan, Ohio, has a 40-page *Catalog No. 46*, describing the complete line of Aro Pneumatic Tools for industry. There are 19 models of grinders; 30 models of drills; and eight types of screw drivers, including the fully automatic "cigar size" Model 7000 for No. 0 to No. 4 machine screws.

BOKUM TOOL CO., 14775 Wildemere Ave., Detroit 21, has available *Catalog No. 464*, describing the Bokum Tool Holder, for holding boring tools in lathes, wherein a vertical adjustment is effected by a conveniently located knurled screw.

ANKER-HOLTH MFG. CO., 2723 Connors St., Port Huron, Mich., has issued a 64-page catalogue, *"Airgrip" Chucks, Cylinders, & Valves*, illustrating all Anker-Holth products.

PROCUNIER SAFETY CHUCK CO., 18 S. Clinton St., Chicago 6, has two new folders available: *Procunier Style "C" Friction Tap Holder*, and *Procunier Quick Change Chucks & Collets*.

EX-CELL-O CORP'N, Detroit 6, has available a 16-page *Bulletin 45361*, with information on their three sizes of "package units" for feeding and rotating cutting tools.

ISLAND EQUIPMENT CORP'N, 101 Park Ave., N. Y. 17, has a new *Bulletin (GP-34)* picturing their Styl-O-Matic Packing and Conveying Unit for the straightline handling of food products from field to jar.

CLEVELAND TAPPING MACHINE CO., Hartville, Ohio, has released a 28-page *Production Tapping Guide*, which gives data designed to assist the estimator, setup man and operator in employing production tapping to the best possible advantage.

METAL TREATING INSTITUTE, 420 Lexington Ave., N. Y. 17, has available a 69-page loose-leaf book, *Manual for Heat Treating Services*, describing the range of such services as well as basic fundamentals, which should materially assist manufacturers to obtain the full advantage of commercial heat treating. Priced at $4 per copy.

DETROIT TAP & TOOL CO., 8432 Butler Ave., Detroit 11, has released *Bulletin DCD-1* explaining its new advanced design center drilling machine for drilling concentric centers in a wide range of stock prior to subsequent machining operations.

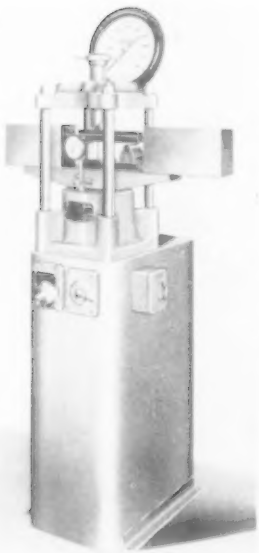
Pictures of Strenes Metal Castings, an eight-page booklet issued by the **ADVANCE FOUNDRY CO.,** 147 Seminary Ave., Dayton 3, Ohio, should be of interest to those concerned with ferrous alloy castings.

TOOLS OF TODAY

Transverse Testing Machine

A **TRANSVERSE TESTING MACHINE**, with a capacity up to 10,000 pounds, is a recent development of *Steel City Testing Machines, Inc.*, 8843 Livernois Ave., Detroit 4. Hydraulically operated, the machine is highly sensitive, and is adaptable to making transverse tests with equal efficiency up to the limit of its capacity. The load is automatically applied at speeds to suit the operator.

To operate, just select the speed, then place the specimen on the supports and raise the load lever, at right on machine. Reversing the procedure quickly returns the ram to its original position. A specially constructed gage with maximum indicating hand is supplied which remains stationary when the specimen breaks, permitting the operator to get accurate reading even though he is not looking at the dial when the ultimate breaking point is reached.



"Arcmeter" for Draftsmen

OF UNUSUAL INTEREST to draftsmen and designers is the **"ARCMETER,"** by the *Arcmeter Company*, Rockford, Ill. The flexible steel beam of the instrument is so designed that it will form a "perfect circle" at any radius on the graduated scale. Adjustment is effected by simply moving the indicator knob to the desired radius on the scale. Moved in either direction, it is self locking.

A timesaver when analyzing or plotting curves, or when making up master layouts, the tool may be used for scribing an arc of radius when the center is beyond the range of a drawing board or available beam compass. Range of radii is from 34.2" to infinity. The tool is 25" long x $3\frac{3}{4}$" wide and, made of aluminum, is light in weight and easily handled. An aluminite finish prevents marking or soiling of drawing paper, and rigid construction insures long, continuous and dependable service.

Roll Thread Comparator

A NEW **ROLL THREAD COMPARATOR**—Model C—has recently been developed by *Pratt & Whitney*, Division Niles-Bement-Pond Company, West Hartford 1, Ct. Provided with Pressure Control, the instrument is designed for easy and accurate inspection of small diameter, hard-to-handle screws. Its use is especially recommended for builders of fine instruments and related industries when thread inspection is necessary on screws of diameters ranging from .060" to .216" and threads ranging from 80 to 28 per inch, National Form 60.

The Model C Comparator uses the J-S gaging principle with a pressure control feature which relieves the operator of the responsibility of judging borderline cases. A signal light instantly shows the result of full "go" and "not go" functional check on pitch diameter, minor diameter, lead and angle.

To operate, the screw is placed in the work holder, where it is held on its major diameter. The operating lever is then depressed and the screw is presented to the gaging rolls. The light is always on except when excessive pressure is applied, at which time it goes out. This feature provides an accurate and sensitive pressure control and is very important because of the tiny size of the screws being checked. This gaging pressure is adjustable to suit the work.

Correctly threaded screws pass the "go" rolls without resistance (light on), but will not pass through "not go" rolls without resistance (light goes out). Oversize screws meet resistance at "go" rolls (light goes out) while undersize screws pass through "go" and "not go" rolls (light stays on).

For this issue, the Tools of Today department is devoted entirely to gages and measuring instruments.

The Editors.

Super-Sensitive Indicators

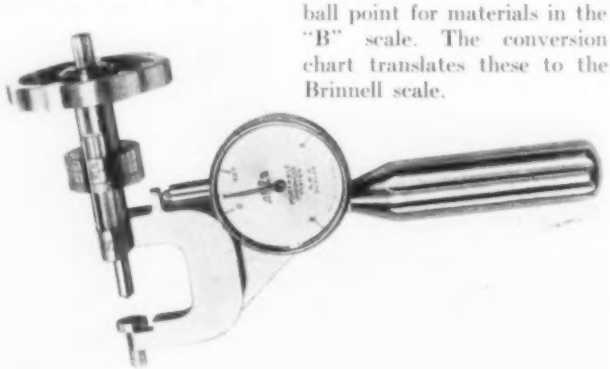
A NEW SERIES of extremely sensitive and accurate master checking **DIAL INDICATORS,** called the "Super," is being manufactured by the *B. C. Ames Company*, Waltham 54, Mass. The overall bezel diameters of the new models are those of the Ames 200 and 300 Series, or 2¼" and 2¾", respectively. The graduations are .0001". The range is .008", with the dial either balanced (4-0-4), or continuous (1-0-8). Every bearing is jeweled.

Very low values of both internal friction (less than 10 grams) and contact pressure (50 grams) result in the indicator being able to follow variations in dimensions as small as one-hundred thousandth of an inch (.00001"). The practical readable accuracy is ¼ of a division, that is ¼ of one ten-thousandth or .000025".

The new indicators are being used as a master check both in the toolroom and on the production line. With a diamond contact, they are also used as surface analyzers to check trueness and finish of ground surfaces, chatter of tools or work, and other surface irregularities. All outside dimensions of these indicators are in accordance with American Gauge Design Committee standards. A variety of backs, to suit the desired mounting, is available.

New Hardness Tester

By the *Ames Precision Machine Co.*, Waltham 54, Mass., is a new portable **HARDNESS TESTER,** now going into production. This instrument, which is unique in its field, employs a diamond penetrator and an anvil, and gages hardness to Rockwell A, B and C scales. The diamond point penetrator is used for testing hard materials in the "C" scale, and the ball point for materials in the "B" scale. The conversion chart translates these to the Brinnell scale.

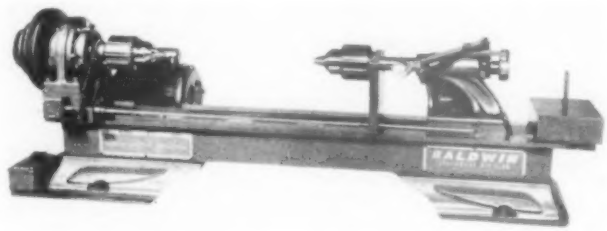


To operate, a test block is placed between the anvil and diamond penetrator; then, the handwheel is turned clockwise until the diamond penetrates the surface of the test block and the dial indicator pointer moves from the "dot" on the dial and rests at "Set." Next, the barrel dial is turned until "0" is located directly beneath the center line of the lucite lens. Dial location effected, the kilogram load is applied.

The handle of the tester is then grasped with the left hand, while the right hand turns the handwheel clockwise until the indicator pointer moves to mark "C" on the dial indicator. The handwheel is then turned back until the pointer returns to "Set," when the center line on the lucite lens should rest over the Rockwell scale reading on the barrel dial. Reading should correspond with the marking etched on the test block.

Torsion Testing Machine

A NEW **TORSION TESTING MACHINE** for wire, developed by the *Sonntag Scientific Corporation* and sold exclusively by the *Baldwin Locomotive Works*, will test bronze and copper trolley wire, telephone and telegraph wire and steel tie wire with diameters from .090" to ¾" in diameter in accordance with ASTM specifications. Three twisting speeds, 10, 20 and 30 rpm, with reversible rotation, are available with a maximum torque of 1000 inch pounds. Stresses up to 80,000 pounds per square inch can be obtained on one-half inch specimens. The specimen can be preloaded in tension, and a reset type counter disengages automatically when the specimen fails.

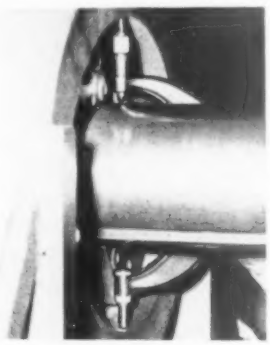


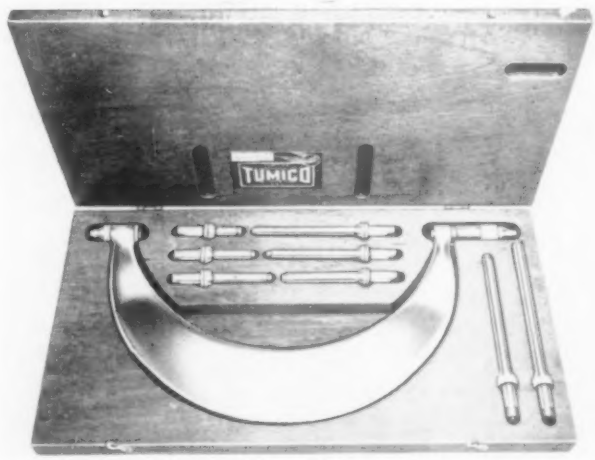
Over-the-Bar Micrometers

A NEW TUBULAR **OVER-THE-BAR INSIDE MICROMETER,** by the *Tubular Micrometer Company*, St. James, Minn., is designed to measure bores without removing boring bars. This feature not only obviates the time and effort to remove and replace the boring bar, but effects a considerable saving in machining costs.

Standard sizes range from 8" to 28", to cover bar diameters from 4" to 8". However, each "mike" will fit over a variety of bar sizes; thus, the 13½" to 18" set shown will cover any bar up to 7½" in diameter. Mandrels, in ½" steps, will fit any bore diameter within the established range.

Made with hollow-box type steel frames, these instruments combine adequate rigidity with the ease of handling that results from a 50% reduction in weight. The frames have a vacuum, in the center, to insure minimum expansion and contraction; hence, hand heat is dissipated and will not affect micrometer accuracy. The large photo shows the instrument, with mandrels, in a hardwood case, while the smaller photo reveals method of applying the micrometer over a bar to determine hole size.





Testmaster Dial Indicator

A NEW TYPE of Testmaster **UNIVERSAL INDICATOR**, constructed with the dial perpendicular to the axis of the body of the instrument, has been placed on the market by *Federal Products Corporation*, Providence 1, R. I. The perpendicular location of the dial makes this new type instrument very useful for general machine shop, toolroom and inspection jobs.

The instrument is especially adaptable for jig borers, and also for certain drill press and milling machine applications where the perpendicular position of the dial greatly improves readability, resulting in greater accuracy. Dovetails, friction clamps and rods provide for the setting of the Indicator to check a wide range of hole sizes, with the dial in a horizontal position.

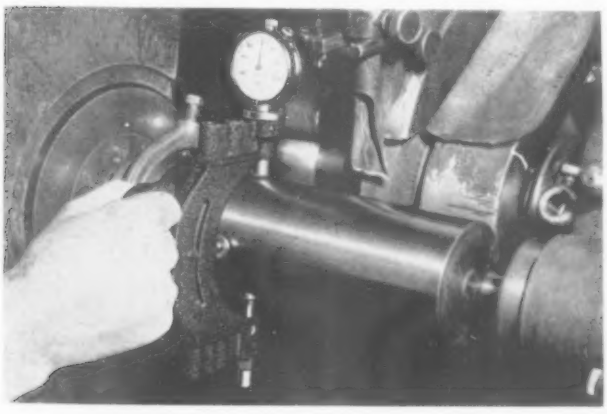
Models 5 and 6 (English) are graduated .001" and .0001" respectively; and Models 7 and 8 (Metric) in .0025 mm and .01 mm respectively. Like the Regular Federal Testmaster, the new Perpendicular model has simple direct combination of lever and crown gear movement and jeweled bearings. Either comes in a plastic case, complete with dovetail clamp and toolpost holding bar.

Decimatic Dial Gage

DEMOUNTABLE HEADS and extension spacers are features of the **DECIMATIC DIAL SNAP GAGE**, recently announced by *Standard Gage Company*, Poughkeepsie, N. Y., of which a single pair of heads and four extension spacers of different lengths cover the unusually long range of four inches with substantial saving in cost as compared with that of the equivalent complete gages.

Using a popular sized Decimatic indicator, these instruments show highly consistent repeatability, and a remarkable freedom from whip and waver of the hand. Both gaging pins are surfaced with cemented carbide to reduce wear. The lower, adjustable pin is flat, while the upper one which actuates the indicator presents a spherical surface. The gage, which is easily set to a master, is operated by passing it over the workpiece and noting the greatest deflection of the hand as the reading. By reversing the indicator to face the operator, the small sizes may be used in a bench stand as comparators.

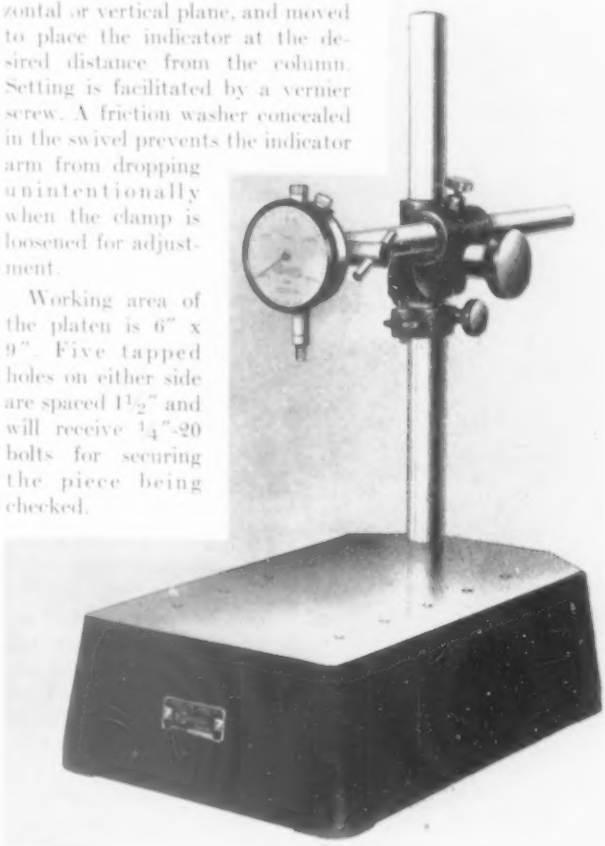
Using any extension spacer, the Decimatic Dial Snap Gage is adjustable over a range of one inch. Sets comprising a complete gage and three extra spacers are available and cover either the range of 0 to 4 inches or 4 to 8 inches.



Also, by *Standard Gage Company*, is a new dial **COMPARATOR MODEL**, designated as No. 107, and suited to a wide variety of uses due to the extensible indicator support arm and the tapped holes, in the platen, for securing the work. Any dial indicator having a standard AGD lug type back may be used.

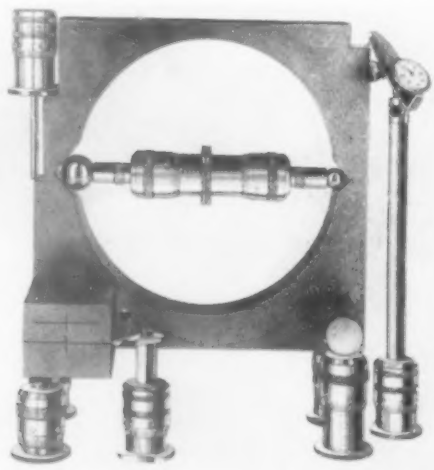
By means of a double clamp arrangement, the indicator support arm may be slid up or down on the vertical column, swung to any angle in either a horizontal or vertical plane, and moved to place the indicator at the desired distance from the column. Setting is facilitated by a vernier screw. A friction washer concealed in the swivel prevents the indicator arm from dropping unintentionally when the clamp is loosened for adjustment.

Working area of the platen is 6" x 9". Five tapped holes on either side are spaced 1½" and will receive ¼"-20 bolts for securing the piece being checked.



Improved Micro Screw Jack

THE **MICRO SCREW JACK**, by the *Engineers Forging Company*, 308 Blvd. Bldg., Detroit, has been improved for wider application. With the addition of ball anvils, it can now be used for internal gaging, and as a depth and height gage in addition to its function as a precision jack for fine adjustments. Sturdy and accurately made, this tool has a wide range of usefulness in toolrooms and inspection departments.



Air Gage Member

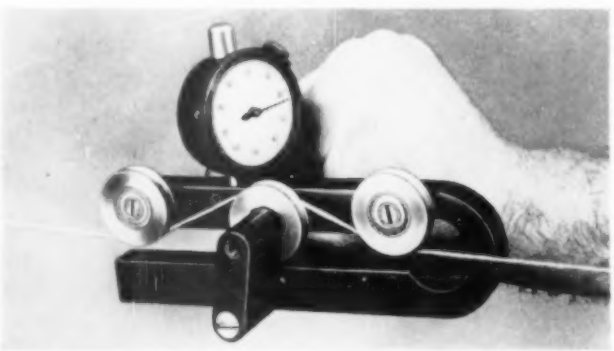
A NEW TYPE of **AIR-GAGING MEMBER,** for use with the Moore Pneumatic Comparator Gage, was recently announced by *Moore Products Co.*, H & Lycoming Streets, Philadelphia 24. This new V-block-type pneumatic unit may be supplied for simultaneous measurement of one, two, or more outside diameters as small as 0.150" or as large as 8". The instrument measures two diameters on the pinion shaft and is currently being used by a leading automobile manufacturer for selecting parts within .00005". Rotating the part in the gage checks out-of-round, and sliding the part axially checks taper. The maximum and minimum masters, by which the gage is set, are shown in the foreground of the illustration.

Since the weight of the part is carried on tungsten carbide wear strips, the V-block-type unit is practically unaffected by wear. The nozzles, which perform the measuring, are recessed below the surface; hence, dirt, oil and coolant, on the work, have no effect on the accuracy of measurement. This gage can, therefore, be installed right at the grinding machine.

The gage is equipped with the Moore Adjustable Compensator which permits positioning the magnification on standard calibrated dials with interchangeable gaging members of various types and sizes.

New Textile Instrument

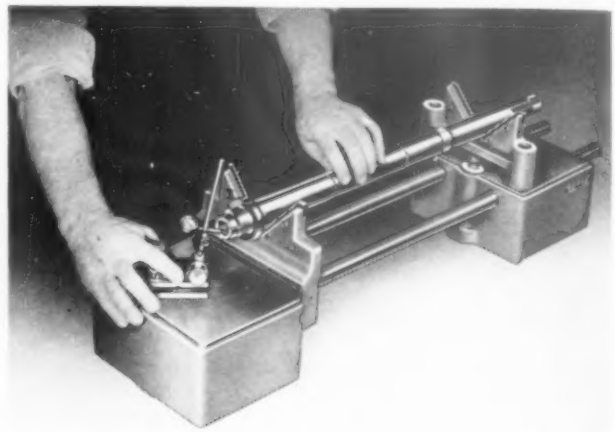
A NEW **TENSOMETER** with a range from 0 to 100 lbs. developed by *Walter Kidde & Company, Inc.*, Belleville, N. J., is designed to be clipped on a moving continuous cord, where it accurately reads the tension in a strand of thread, cord or yarn directly in pounds. Rapid fluctuations in tension are recorded with very small error due to the sensitive movement of the measuring members.



Aluminum alloy is used for the handle, and the frame is finished with a corrosion resistant coating. The wheels for carrying the cord are made of stainless steel and are mounted on precision ball bearings.

New Inspection Tool

A NEW TOOL—the **V-LINER,** by *Swanson Tool & Machine Products, Inc.*, Erie, Pa.—greatly simplifies concentricity checking on a wide miscellany of close tolerance machine parts. The tool, which is self contained, replaces conventional V-block and incidental aligning tools, as well as gage blocks, height gages, indicators and surface plates ordinarily used to check or inspect relative concentricity on round parts or sections.



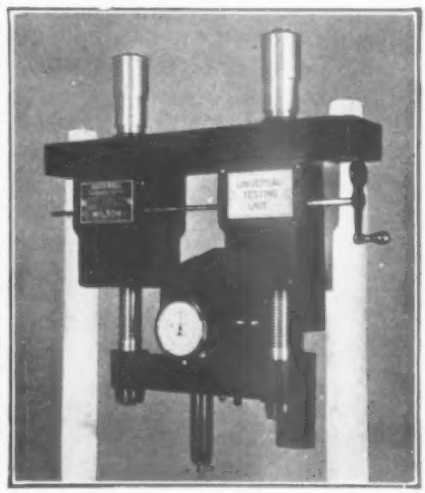
As per illustration, the tool consists of two V-blocks, one of them movable, mounted on solid members which are held in alignment by hardened and ground cylindrical rods. The movable V-block (see far end) is provided with a hardened adjusting screw and bronze nut, which raises or lowers the V on guides and accurately calibrates and compensates for the sine of the V.

By simply setting the adjusting screw, in accordance with the graduations indicated thereon, to correspond with the diametrical difference between any diameter in any piece to be checked, the V-Liner is ready to position the part in perfect horizontal plane for checking. As an example, if one section of a shape is 3" diameter, and the other section 2½", it is only necessary to turn the adjusting screw, under the movable V, to the ½" setting.

Universal Hardness Tester

A UNIVERSAL **HARDNESS TESTING UNIT,** by the *Wilson Mechanical Instrument Co.*, 383 Concord Ave., New York 54, is designed for checking hardness on large and heavy work which cannot be readily tested on standard and superficial "Rockwell" hardness testers.

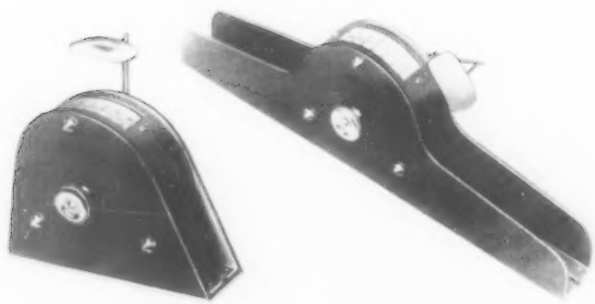
The Unit, which is shown dark in the illustrations, may be mounted in whatever design of frame (as suggested by the portion in phantom) the user may build to suit specific testing needs. When so mounted, large gears, rolls and other bulky or heavy pieces may be handled in an easy and convenient manner.



Angle and Vernier Gages

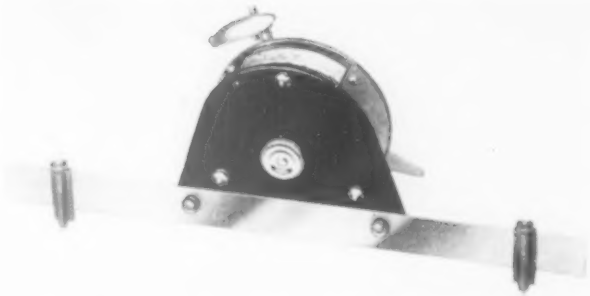
SEVERAL GAGES in the "Clinometer" line, by *Engis Equipment Co.*, 431 So. Dearborn St., Chicago 5, include the **MICROPTIC PRECISION CLINOMETER** (large photo) and the **MODELS A, B, AND C CLINOMETERS.**

A precision angle checking device, the "Microptic" consists of a light alloy body containing an accurately divided glass circle and an optical reading system, and optically checks angles over the full 360° circle to .05 minutes of arc. Among many other applications, it can be used to quickly check the accuracy of a sine bar.



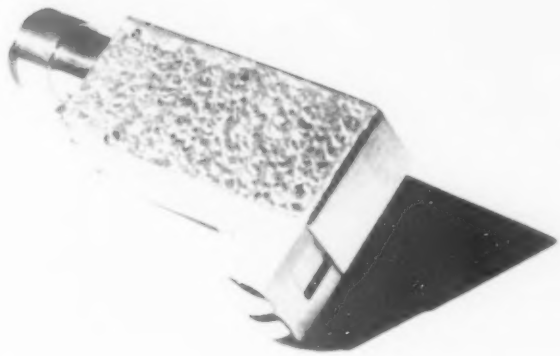
Models A and B (right and left in montage) are the two models of Clinometers recommended for general purposes. Action of these instruments, which have been recently improved, is by a free swinging drum graduated 360° and supported on ball bearings. When applied to any inclined surface, the drum swings into position that aligns the center of gravity with the center line. Inclination, in degrees, is then read from a pointer located above the drum. A separate Vernier scale provides accurate readings to 1 minute of arc.

Model C (following) is especially adapted to inspection in the aircraft industry. It operates in the same manner as Models A and B, and quickly and independently checks pitches of propellers; and also plane surfaces on fuselages, wings and other locations to 1 minute of accuracy. The straight edge is removable, and templates to fit the work can be substituted.



New Profilometer Tracer

A SELF-ADJUSTING, hand-operated **PROFILOMETER TRACER,** just introduced by *Physicists Research Co.*, Ann Arbor, Mich., and known as the Type MA, replaces the Type M Tracer as standard equipment with all Profilometers. It is also available separately.



Hand operation of the Tracer has always been an important Profilometer feature, because of its convenience and efficiency, and this feature is now greatly enhanced by the complete elimination of the tedious adjustment of the tracing point to the surface being measured. Operation of the new Tracer consists merely of placing the instrument on the surface, moving it to and fro, and noting the micro-inch reading.

The Type MA Tracer is also considerably smaller than the old Type M. It will go completely through a 1½" I.D., and only two skid yokes are needed to handle all surfaces. No adaptations are needed to use the Tracer with any Profilometer now in use.

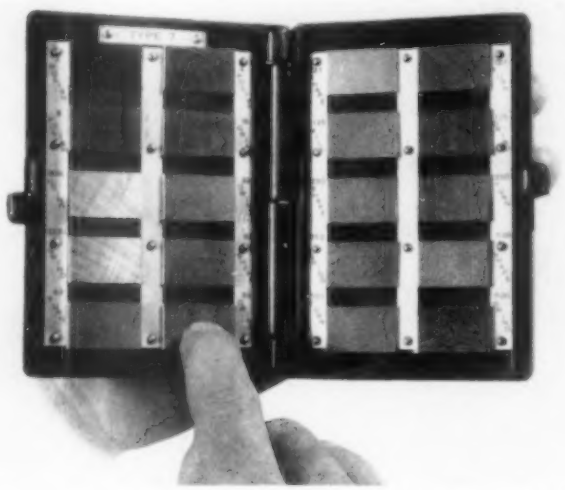
Angular Straight Edge

AN **ANGULAR STRAIGHT EDGE** has recently been introduced by *Machine Products Corporation*, 6771 E. McNichols Rd., Detroit, builders of surface plates, angles, and other precision measuring equipment. The tool is made of heat-treated Mechanite, in any size from 18" to 84" in length, and to any angle specified. Two faces are hand scraped.

This is said to be the first ready-built angular straight edge ever marketed on a commercial basis. It was designed especially for machine builders, and for machine rebuilding or repair work to simplify the task of scraping and checking of machine ways and slides. It can be used with or without handles at each end, and is supplied with felt lined wood case.

Surface Finish Standards

CONFORMING TO the "preferred-number" series which the American Standards Association has recently adopted for designation of surface finish, a handy pocket set of **STANDARDS**, by *University Machine Co.*, Cambridge, Massachusetts, affords convenient means of checking surface finishes over a wide scale of roughness. The set consists of 20 small blocks of stainless steel, each of which is accurately machined to the surface finish specified for one of the "preferred-number" standards. The inspector checks finish by drawing his fingernail across the specimen and across the standard.

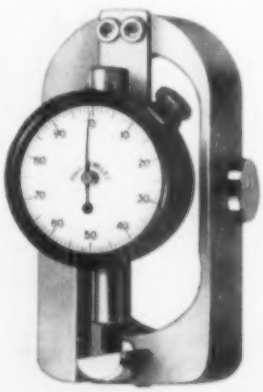


The Standard surfaces established by A.S.A. and the finishes furnished in the University Type 7 Standard are: 2, 4, and 8 microinches polished; 16 and 32 microinches ground (straight and Blanchard); 63 microinches shaped, turned, and ground; 125 microinches shaped, turned, milled, and ground; 250 and 500 microinches shaped, turned, and ground. Edward Blake Company, 634 Commonwealth Ave., Newton Centre, Mass., are sole distributors.

New Pressure Gage

COMPACT AND WIDELY applicable, a new **PRESSURE GAGE** by *W. C. Dillon & Company*, 5410 W. Harrison St., Chicago 44, may be used to check pressure between spot welding electrodes; pressure between platens on all types of presses; pressure between moving rollers; and tension in moving thread, twine and wire.

Purposely made small and compact to fit tight spots ordinarily inaccessible, the instrument is available in six size ranges to fit most requirements. The 0-100 lb. Model measures 3⅝" long x 2-7/32" high x 1¾" wide, and weighs only 1¼ lbs.; with the outside range—0-2500 and 0-5000 lb. Models measuring 4⅝" x 2⅜" x 2¾", and weighing but 2½ lbs. A 10,000 lb. model is being developed.

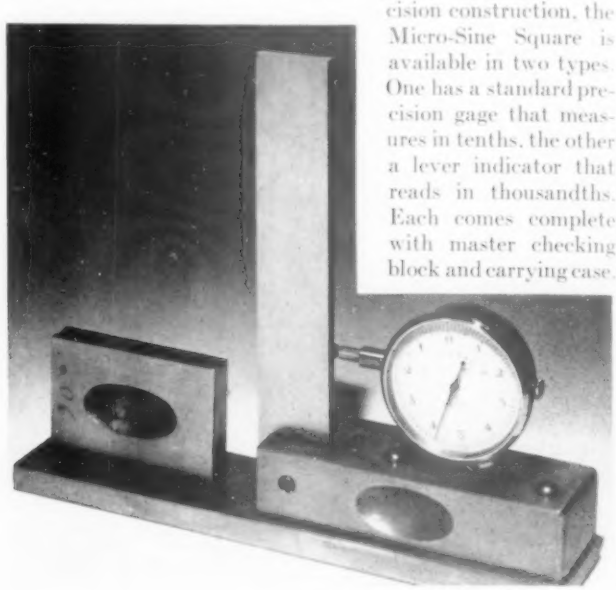


Extremely versatile, the instrument works in vises, or between clamps and can be converted into a miniature testing machine. When the operator cannot get close enough to the dial for easy reading, remote repeater stations can be supplied that work up to 500 feet. Unaffected by temperature changes, the instrument can be used indoors or out, as desired.

New Micro-Sine Square

A NEW PRECISION **ANGLE SQUARE**, recently announced by the *Acro Tool and Die Works*, 4554 Broadway, Chicago 40, and sold under the trade name Micro-Sine Square, is specially designed to enable shop men to quickly check right angles and accuracy of work to .0001" within a given distance. A needle instantly indicates error on a dial and also shows where, and how much correction is required. The tool provides a standard for checking master squares, tri-squares and tools, as well as jobs.

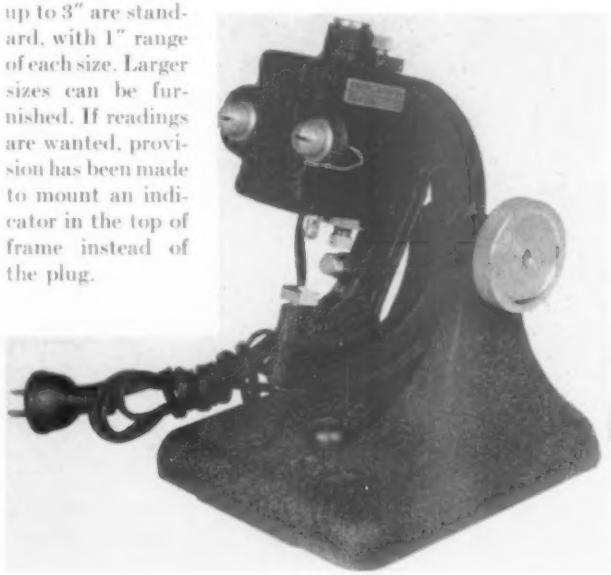
Made of hardened tool steel, with ground and lapped precision construction, the Micro-Sine Square is available in two types. One has a standard precision gage that measures in tenths, the other a lever indicator that reads in thousandths. Each comes complete with master checking block and carrying case.



Electronic Snap Gage

THE *Yankee Precision Products Company*, 50 Bartholomew Ave., Hartford 6, Connecticut, announces a new **ELECTRONIC SNAP GAGE** for production inspection. A recently developed Electronic Gage Head has been mounted on Snap Frames and, for convenience in inspection of small parts, the unit can be mounted on a stand. A locking arrangement on the stand allows the gage to be set in any vertical position.

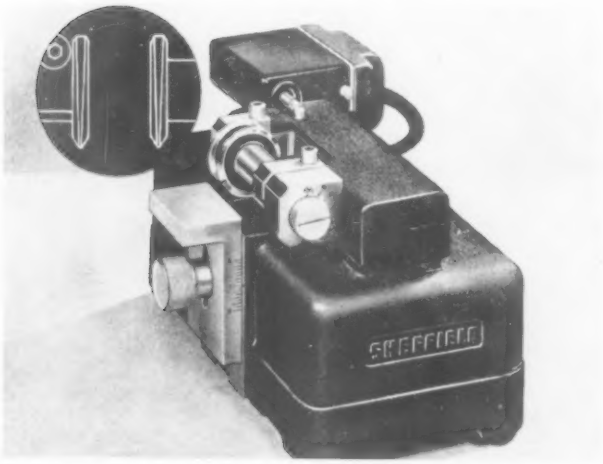
The Gage operates on 110 volt, 60 cycle, single phase current; and sizes up to 3" are standard, with 1" range of each size. Larger sizes can be furnished. If readings are wanted, provision has been made to mount an indicator in the top of frame instead of the plug.



Sheffield Leadchek

A PRODUCTION **LEADCHEK** with novel and interesting features, recently announced by the *Sheffield Corporation* of Dayton, Ohio, has adjustable truncated cylindrical gaging anvils which make possible precision checking of thread lead within a range of 4½ to 60 threads per inch to an accuracy of .0001" on production parts such as aircraft components, studs, small shafts and similar units.

This instrument offers a flexibility to accommodate a wide diametrical range of thread work parts, combined with great ease of initial set-up and change-over, as well as rapid and precise measurement of the lead. It is ideal for use in receiving, production and final inspection, as well as in plants and shops running small lots of a wide range of sizes.



The new Sheffield Leadchek may be obtained with either of two types of gaging heads: a "tenth" dial indicator for lead tolerances within the indicator range, or an Electrigage for more accurate gaging where lead tolerances are as narrow as .0001". The latter, an electrical gaging head developed jointly by Westinghouse and Sheffield, is used on a number of Sheffield instruments. The adjustable truncated cylindrical gaging anvil can be moved and locked in place at any point within a range of .200" to 2.000". Both gaging anvils are adjustable for the desired pitch.

ALSO, BY *Sheffield Corporation*, is a new Precisionaire **INTERNAL MEASURING INSTRUMENT** for the accurate checking of small rings from 5/32" to 1" internal diameter. The rings may be explored to a depth of 9/16" from each side by hand wheel vertical adjustment of the diamond tipped gaging arms; however, the instrument also indicates taper, bellmouth and out-of-round conditions.

Precision gage blocks are used in setting the instrument, which is of the comparator type with amplification approximately 35,000 to 1. Deviations from the master setting of less than five millionths of an inch are easily read, as each graduated space representing five millionths occupies .175" on the scale.

ANOTHER NEW gaging instrument, known as the **MEASURAY**, is also being offered to industry by the *Sheffield Corporation* which has acquired exclusive manufacturing and sales rights. A rather remarkable instrument, it utilizes an entirely new X-ray and electronic application for non-contact, continuous or spot checking of thickness of all types of moving materials to an accuracy, when required, within one per cent of the material being checked.

The Measuray can be applied to almost any production process where it is desired to measure and regulate the thickness of material. It is suitable for use with brass, copper, steel, aluminum or any other metal; paper, plastics, composition material, film, rubber, cellophane in the form of sheets, or metal or foil of any kind, which can be checked for thickness to an accuracy of one per cent just as easily as sheet materials 3/16" thick. Concentricity can likewise be checked to measure a wire surrounded by insulation; and wall thickness of tubing can be checked at any point without cutting.

While tolerance and thickness limitations are dependent to some extent on the density of the material to be checked, precise accuracy is maintained regardless of whatever changes may occur in the product, or whether speed of movement of material is at the rate of 5 feet or 5,000 feet per minute. Accuracy is not affected by the temperature of the room, nor of the stock; for example, sheets or strips coming hot from the rolls give the same indication when cooled to room temperature.

The Measuray, which is actually a comparator, uses masters to compare the thickness of material, in percentages, with a sample of the same material which has the required known dimension. Standard units are equipped with indicating mechanisms, while recording and machine control devices are available.

The gage head is placed at a convenient location at any desired distance, and can be so located that the moving stock passes between the X-ray source and the detector. The electronic power supply and amplification units may be set wherever desired.

Pipes Measured From Outside

A NEW **PIPE THICKNESS GAGE**—Type MS-A—by the Special Products Division of the *General Electric Company* is designed to measure the wall thickness of iron or steel pipes from the outside. The new instrument can be used on pipes up to ¼" wall thickness and from 1" to 2" in diameter. Applications include checking the safety factor of pipes and tubing carrying petroleum products, chemicals, steam or gas.

The new thickness gage consists of an indicating instrument, a gage head, and a saddle which is connected to the gage head by two screws. A different saddle is required for each diameter of pipe. To operate, the saddle is placed upon the pipe, and thickness is indicated in fractions of an inch on the indicating instrument.

The gage measures the average thickness of a pipe over an area of several square inches. Accuracy of plus or minus 1/64" can be obtained on clean surfaces, and 1/32" on dirty surfaces; however, dirt, scale and paint on the inside of a pipe do not add to the thickness reading. The gage head and saddle combination weighs about 6½ lb., and the instrument operates on 115-volt, 60-cycle power.

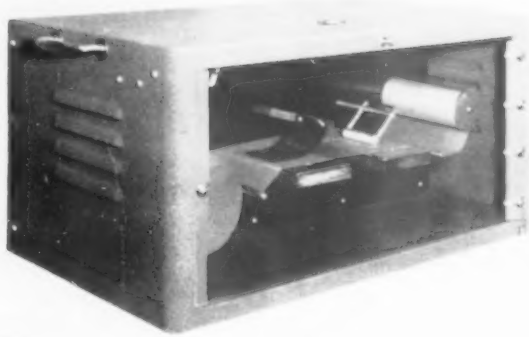
Quality Control Instrument

A NEW **FLAW DETECTOR,** by the Special Products Division of the *General Electric Company*, is designed to continuously detect and count holes, weak spots, and conducting paths in thin materials such as paper, sheet rubber, sheet mica, varnished cloth, plastic materials, and enamel films on wire during the manufacturing process.

The instrument permits quality standards to be set up close to the point of manufacture so that variations in quality can be quickly detected and corrected. Applications include detecting places of low dielectric strength in insulating materials, and holes in materials which must resist the passage of light or air.

The flaw detector can be applied to sheet materials up to .025" thick moving as fast as 450 ft. per minute, and to wire up to 100 ft. per minute. The instrument consists of an electrode assembly through which an adjustable voltage is applied to the material undergoing test, and an electronic circuit which indicates the flow of current through the material which occurs when a flaw passes under the electrode. Electrodes have been especially designed for use with specific materials.

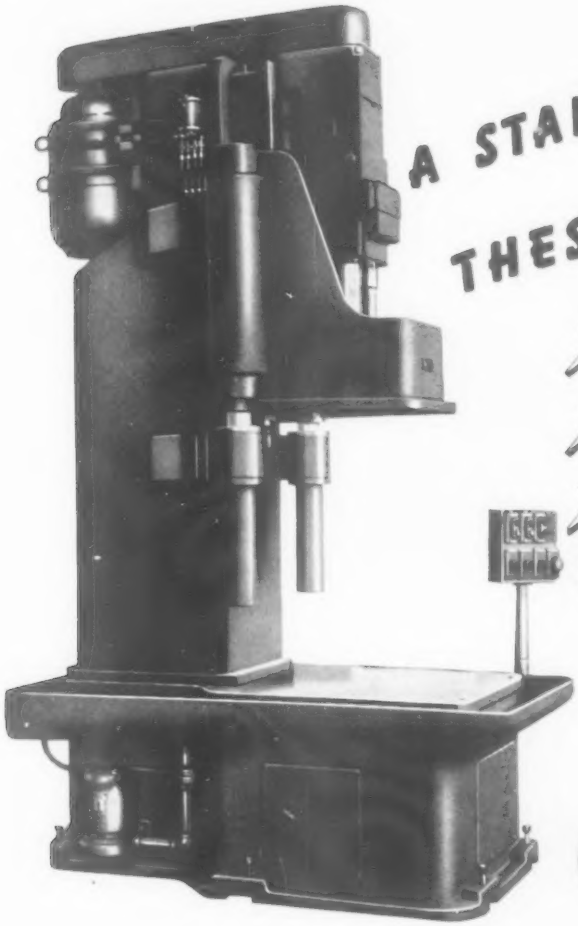
The new flaw detector can be made to sound an alarm, to operate a recorder, or to shut down the manufacturing process when flaws are encountered, and can also be arranged to indicate when flaws exceed a given total. The control unit may be mounted remotely, where an operator can read the counter or watch for flashes of a flaw-indicating red light.



Calculator For Presses

A **CALCULATOR,** for quick selections of the proper press for blanking, drawing and other press operations, is now available from the *Calculator Company*, P. O. Box 65, Teaneck, N. J. The device, which was developed by Len Crary, an engineer with the E. W. Bliss Company, gives the crankshaft diameter and tonnage, at bottom of the stroke, on blanking jobs.

On drawing work, diameter and tonnage are given, *away from bottom of stroke;* also the maximum press speed for the metal being worked. Capacity ranges up to 1000 tons, with crankshaft up to 10" diameter and strokes from 3" to 32". The Calculator, which retails at $15.00, is supplemented with an explanatory booklet and comes complete in a leatherette case.



A STANDARD MACHINE WITH THESE 3 Advantages

- LOWER INITIAL COST
- REDUCED MAINTENANCE
- EASILY ADAPTED TO SPECIAL PURPOSE OPERATIONS

THE Robbins No. 3 Drillmatic

The Robbins No. 3 DRILLMATIC is designed and built as a STANDARD MACHINE specifically for special purpose drilling, reaming, tapping and boring operations *at lower cost*. Drill heads with any number of spindles are easily mounted on the tooling saddle and by use of auxiliary units around a special base, multiple operations may be performed vertically, horizontally or any angle in between. When operations are changed, the No. 3 Drillmatic can be economically converted to the new job.

Old-type soft ways are replaced by large diameter guide bars in the saddle. These bars slide in guide bushings on the oversize machine column. Both the bars and bushings are hardened and ground alloy steel . . . automatically lubricated. The saddle is actuated by a sturdy hydraulic ram directly over the work, reducing friction on the guide bars and further contributing to the life-time wearing qualities of both the bars and bushings.

The hydraulic power is contained in a compact unit which is stationary at the top of the machine column . . . no outside piping or valves and all connections are manifolded inside the unit . . . no leaks. Two separate adjustable feed rates are supplied and a wide variety of speeds is obtainable by using change gears within the unit or by changing V-belt pulleys.

Send for illustrated catalog which details the many "plus" features of construction and operation. Study them over; then consult with Robbins engineers on the applications in your plant. Robbins is qualified to design and build the tooling for your entire job . . . tooling that will do the job faster, better, more economically. ***Robbins Engineering Company, 318 Midland Avenue, Detroit 3, Michigan.***

Robbins ENGINEERING COMPANY

Producers of ROBBINS MAGNA-SINE • ROBBINS UNIV-ANGLE ROBBINS SINE PLATE • ROBBINS INDEX TABLES ROBBINS No. 3 DRILLMATIC • SPECIAL MACHINERY

North East West South in Industry

R. E. THOMAS, appointed Purchasing Agent for the **Dumore Company,** Racine, Wis., had previously served for two years as chief accountant. Before joining Dumore, he was secretary-treasurer of the Indianapolis Brass & Aluminum Foundry. Mr. Thomas succeeds G. K. Tollaksen who has resigned to enter his own business.

ALLEGHENY LUDLUM STEEL CORP'N, Pittsburgh, has consolidated sales development and engineering service under managership of **W. B. Pierce.** Also announced is the election of **Robert M. Arnold,** President of **Arnold Eng'g Company,** Chicago, to the Board of Directors. Arnold Engineering is a wholly-owned subsidiary of Allegheny Ludlum, having been acquired in January, 1946.

A. W. LOVELL (left) has been named Gen'l Mg'r. **Modern Collet & Machine Co.,** Ecorse, Michigan. Sales Mg'r since '44. Mr. Lovell was previously management engineer with Booz, Allen & Hamilton, assigned to the Sperry Gyroscope Company. Additionally, **Henry Hillerman** has been promoted to Sales Manager for Modern Collet.

EMERSON H. MOOK, INC., an advertising agency which specializes in the preparation and placement of machine tool advertising, has recently opened offices at 5025 N. Main St., Dayton, Ohio.

Gorton M. Evans has been named Purchasing Agent, and **Robert L. Crinnian,** Ass't Chief Eng'r, **PIONEER ENG'G & MFG CO.,** according to announcement by **A. M. Sargent,** President. After leaving Cornell University, Mr. Evans worked for eight years in the purchasing dep't of Detroit Gear Div'n, Borg Warner Corp'n, before joining Chrysler Corp'n where he remained three years, after which he returned to Borg Warner. Mr. Crinnian, a founder and past president of the American Society of Industrial Eng'rs, is at present Chairman of its Board of Directors. He will assist in supervising Pioneer's staff of process, plant layout, and production engineers.

Edwin H. Halvorsen, President, Cro-Micron Process & Research Corp'n, 180 Mulberry St., Newark 2, N. J., has announced opening of a branch plant, **WESTERN CRO-MICRON PROCESS & RESEARCH CO.,** San Carlos, California. **Frank Coleman** and **William F. Klose** are the new branch managers for Cro-Micron.

FEDERAL PRODUCTS CORP'N, Providence, R. I., has acquired sole manufacturing rights for the **Federal-Metricator Air Gaging** system. Manufacturing facilities, formerly located at Ann Arbor, Mich., have been transferred to the Federal plant at Providence, R. I.

OLOFSSON TOOL & DIE COMPANY—manufacturers of dies, jigs, precision gages and special machinery—announces occupancy of new and enlarged quarters at 2727 Lyons Avenue, Lansing, Michigan.

WALTER S. PRAEG (right) has been elected President, **Nat'l Broach & Machine Co.,** Detroit, to fill the vacancy created by the death of **Robert S. Drummond.** Mr. Praeg has been a member of the organization since its beginning. **J. Irvin Schultz,** former treasurer of the company, was elected Vice-President and Treasurer.

For many years closely affiliated and under one management, **Rolled Thread Die Co.,** and **Reed Small Tool Wks** have been consolidated as **REED ROLLED THREAD DIE COMPANY.** Plant location—237 Chandler St., Worcester 2, Mass.—remains the same. No changes in policy or personnel are contemplated, and present representatives are to be retained. The company will specialize in thread and form rolling tools and machines.

Clarence Snyder (right) President **SNYDER TOOL & ENG'G CO.,** Detroit, recently awarded pins to 44 employees who had been with the company from five to 20 years. Mr. Snyder has also announced the naming of **Joseph Savage** (left) as Factory Manager. Other appointments include **Howard N. Maynard** as Vice-President; **George H. Whitehouse,** Vice-President in Charge of Sales; and **Kenneth B. Hollidge,** Sec'y.

CUTTING TOOL MFG'RS ASS'N, at their annual meeting in Detroit, elected **E. A. Goddard** as President. Mr. Goddard is Vice-President of the Detroit cutting tool firm of Goddard & Goddard. **R. H. Wolfe,** President of Arrow Tool & Reamer Co., Detroit, was re-elected Treasurer; and **D. E. Van Deusen,** President of Kelley Reamer Co., Cleveland, was named Vice-President.

New C.T.M.A. Directors are: **Emil Gairing,** President, Gairing Tool Company of Detroit; **Malcolm F. Judkins,** Chief Eng'r, Carbide Div'n, Firth Sterling Steel Co., McKeesport, Pa.; **John K. Penny,** President of U. S. Broach Co., Detroit; as well as Mr. Goddard and Mr. Van Deusen.

Defiance Machine Wks, Defiance, Ohio, has named **EDMUND BURKE CO.,** Toledo, machine tool distributor for the northwestern Ohio area.

ROBERT F. GOLDEN (right) is to be in charge of the newly established **Research & Development Dep't,** *Eaton Mfg. Co., Reliance Div'n,* Massillon, Ohio. Other Eaton appointments include **Kenneth I. Silvis** to the company's Snap Ring Sales Dep't; **Ralph O. Amsden, Jr.,** to the Detroit office; **John S. Kerr** to Cleveland; **John L. Knott,** New York; and **Clifford A. Esinhart** named western railroad representative in Eaton's Chicago office.

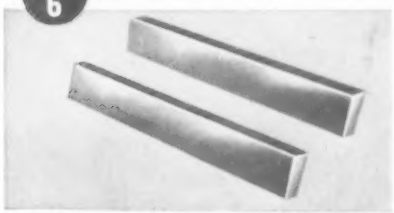
for high production at low cost

HAYNES STELLITE metal-cutting tools are made of specially developed alloys of cobalt, chromium, and tungsten. They are used efficiently and economically for machining most machinable materials—and for nearly all machining operations. These uniform, dependable tools operate at heavy feeds and high speeds—with long life between grinds. This means high production at low cost per piece machined.

You can order HAYNES STELLITE standard tools or special tools to your specifications through any Haynes Stellite Company Office. For more descriptive information, write for your copy of the new revised edition of "HAYNES STELLITE Metal-Cutting Tools," Form 5401.

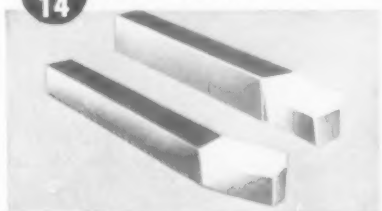
AVAILABLE STANDARD TYPES

PAGE 6 SOLID TOOL BITS



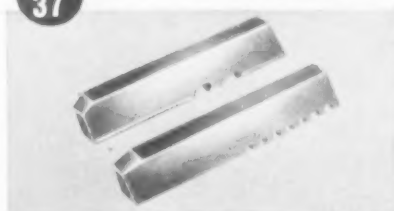
Square, flat, or round—in a wide range of sizes—finish-ground ready for use.

PAGE 14 TIPPED TOOLS



A large variety of styles and sizes—for use where solid bits are impractical.

PAGE 37 MILLING CUTTER BLADES



For many cutter body types—supplied finish-ground to close tolerances.

HAYNES alloys

TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles
New York—San Francisco—Tulsa

The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

INCREASE *Production*...
DECREASE UNNECESSARY HEADACHES BY ORDERING CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES

The most efficient tools are brazed with carbide tips on hardened high-speed steel bodies, so that the total length of the flutes and pilots Rockwell C-62-63.

It has also been proven in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less spring back under heavy cuts for this same reason. Also, the flutes and pilots will not score or pick-up due to the hardness of the high-speed steel and long wear on the pilot.

If you have a cutting tool problem, DETROIT REAMER & TOOL COMPANY would appreciate an opportunity to work it out with you.

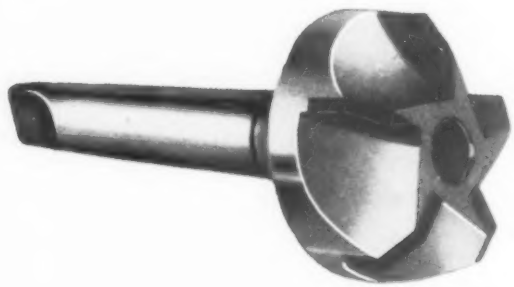
Write for QUOTATION

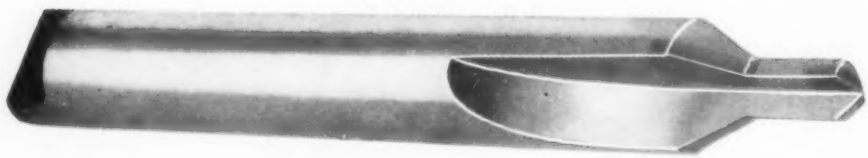
• MADE TO YOUR SPECIFICATIONS •

DETROIT REAMER & TOOL CO.

2830 E. Seven Mile Road — Detroit 12, Michigan

Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools





SUBLAND REAMERS
•
LINE REAMERS
•
CENTER DRILLS
•
COUNTERBORES
•
CORE DRILLS
•
END MILLS
•
Special Tools To Your Specifications

Part is a tread pin, 18 in. long by $1\frac{3}{8}$-in. dia. Material is SAE-1045 cold-rolled steel. Requirements are 50-55 Rockwell "C" at surface, $\frac{1}{8}$-in. depth of case, without changing core structure.

ONE 18" PIN EVERY 3 MIN.

SURFACE HARDENED TO 52 R "C" by High-Frequency Heating

This tread pin is an example of one advantage of high-frequency heating—obtaining a uniformly hard surface and ductile core without resorting to alloy steel or carburizing.

Pins are progressively surface hardened to 1/8-inch depth at 6 inches per minute while rotated at 30 rpm. Surface is heated to 1550 F and immediately water quenched.

A surface hardness of 52 to 55 Rockwell "C" is obtained, while core remains at approximately 20. Warpage, over the 18 inches, is 1/32 inch or less. No finishing is required because of negligible scale. Working conditions are clean and cool, and since operation is automatic, an unskilled operator can produce excellent and uniform results.

The heating coil was developed by Lepel Laboratories for use with a 30-kw spark-gap converter. Manufacturer developed the motor-driven carriage, mounted on a Lepel quench tank, which provides the progressive feeding and rotation of the pin.

SOLDERING
BRAZING
HARDENING
ANNEALING
MELTING

The same Lepel Spark-gap Converter will handle any or all of these processes, usually with advantages similar to those given in this advertisement. Often this unit will prove substantially more economical than any other high-frequency generator—*particularly when heating non-ferrous or non-magnetic materials.* Changing from one job to another can be done in less than 5 minutes.

If you have any operation—on ferrous or non-ferrous materials—which you suspect can be handled by high-frequency heating, let us make a preliminary check. If at all promising, our engineers can run tests, on samples you supply, and report just what can be done. There is no obligation: inquiries are treated with strictest confidence.

A letter to us will bring you, as you prefer, more information or a call by a representative. Any description of part or process may enable us to furnish, immediately, specific helpful data. You can help us by mentioning this advertisement.

HARDEN

SOLDER

BRAZE

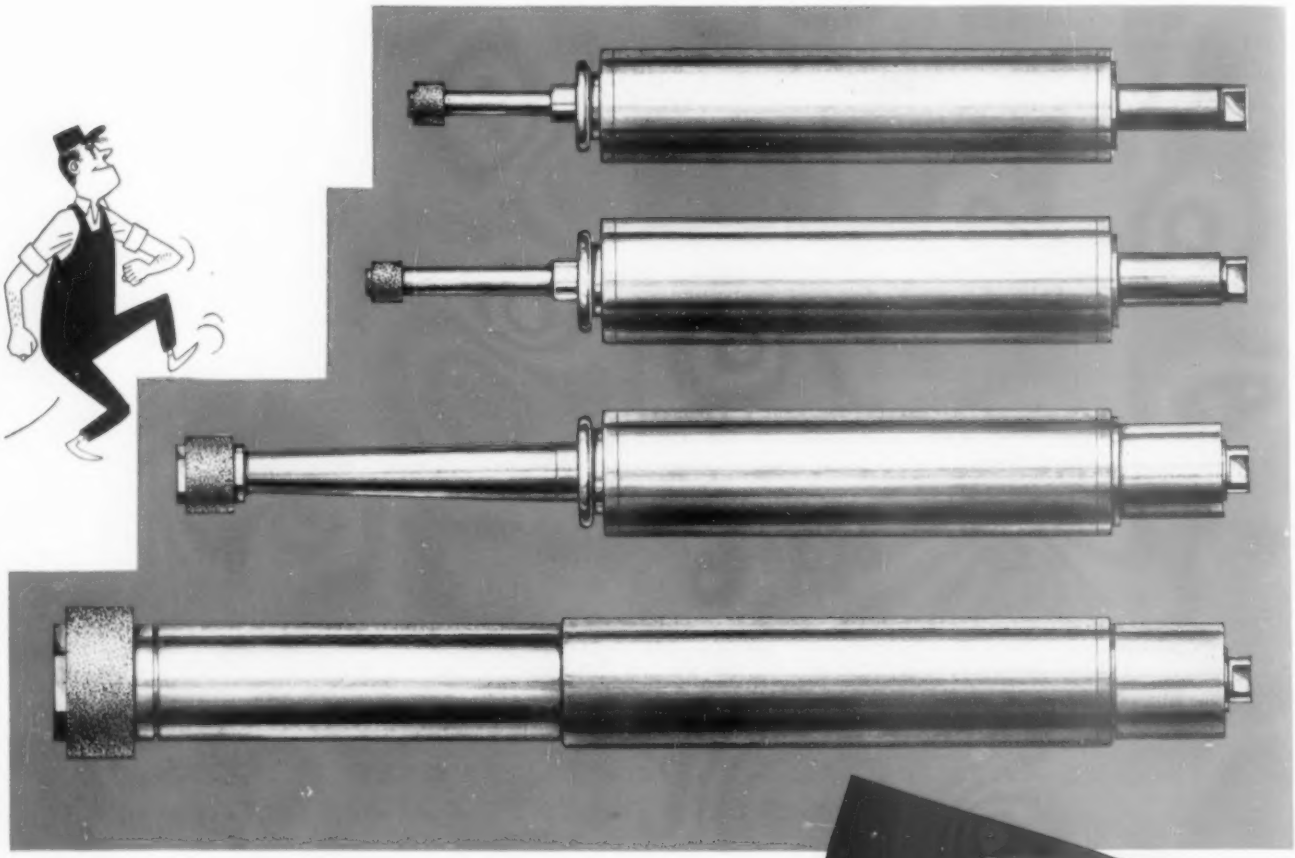
MELT

LEPEL HIGH FREQUENCY LABORATORIES
39 WEST 60th STREET, NEW YORK 23, N. Y.

Lepel
HIGH-FREQUENCY HEATING UNITS

Step Up ***Production of Accurate Sized, Smooth Finished Holes***

with POPE Sealed Lubrication INTERNAL GRINDING SPINDLES



Pope Precision Internal Grinding Spindles come in the sizes, shaft extensions and speeds (up to 35,000 RPM) to meet your every need. The four, illustrated, all fit the same machine without changing motor pulley size.

CATALOG
NUMBER 56
NEW,
JUST OFF THE PRESS!
This new and complete Ready Reference Catalog No. 56 contains all the information you need to select the best Internal Grinder Spindle for your job.
ASK US TO MAIL YOU A COPY

No. 40

POPE

POPE MACHINERY CORPORATION

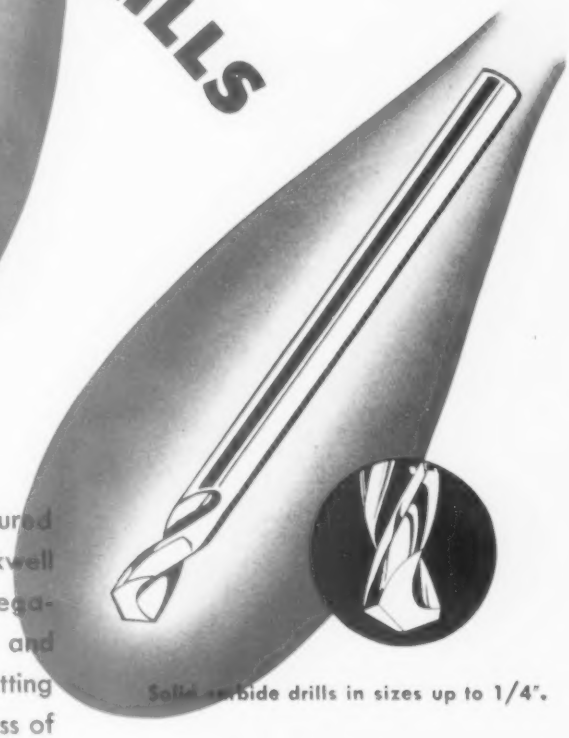
ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

DRILL HARDENED STEEL WITH ACE "Hi-Brinell" DRILLS

Carbide tipped drills from 17/64" to 1/2".



Solid carbide drills in sizes up to 1/4".

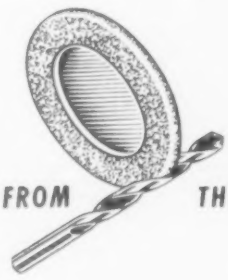
Ace "Hi-Brinell" Drills are designed and manufactured especially for drilling steel hardened to a Rockwell C40-C65 and above. • These drills have ample negative rake thus eliminating thin projecting angles and permitting a faster flow of heat from the cutting edges. Negative rake also adds to the ruggedness of the drill. • The *solid* carbide drill has an extra heavy web. • Reclaiming costly dies is only one of the many profitable applications for Ace "Hi-Brinell" Drills.

ACE DRILL CORPORATION

MANUFACTURERS OF GROUND-FROM-THE-SOLID DRILLS AND REAMERS

DETROIT 27, MICHIGAN

Ace also produces spiral fluted drills with spiral carbide tips for drilling abrasive non-ferrous materials.



GROUND FROM THE SOLID

2392

DRILL JIG

BUSHINGS

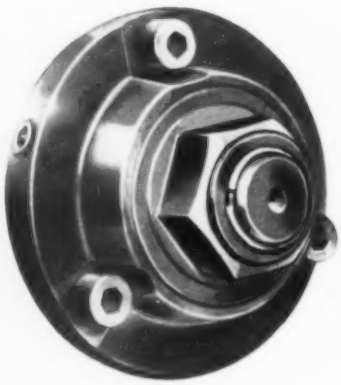
All A.S.A. STANDARD types and sizes in stock for immediate delivery.

Excellent delivery on NEW GAGES and GAGES salvaged by HARD CHROMIUM PLATING.

Write today for particulars

ECONOMY TOOL & MACHINE CO.

MILWAUKEE 14, WISCONSIN



TWENTY YEARS OF

LOCK AND FIXTURE DEVELOPMENT

DESIGNERS—BUILDERS

ALL TYPES OF SHOP

PRODUCTION TOOLS

SATISFACTION GUARANTEED

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley Avenue — ASK FOR CATALOG 238G — Detroit 27, Michigan

Cleveland—J. W. Mull, Jr.
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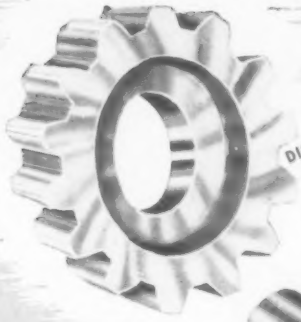
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
Boston—A. R. Shevlin Co.
Los Angeles—Production Tool Engineering

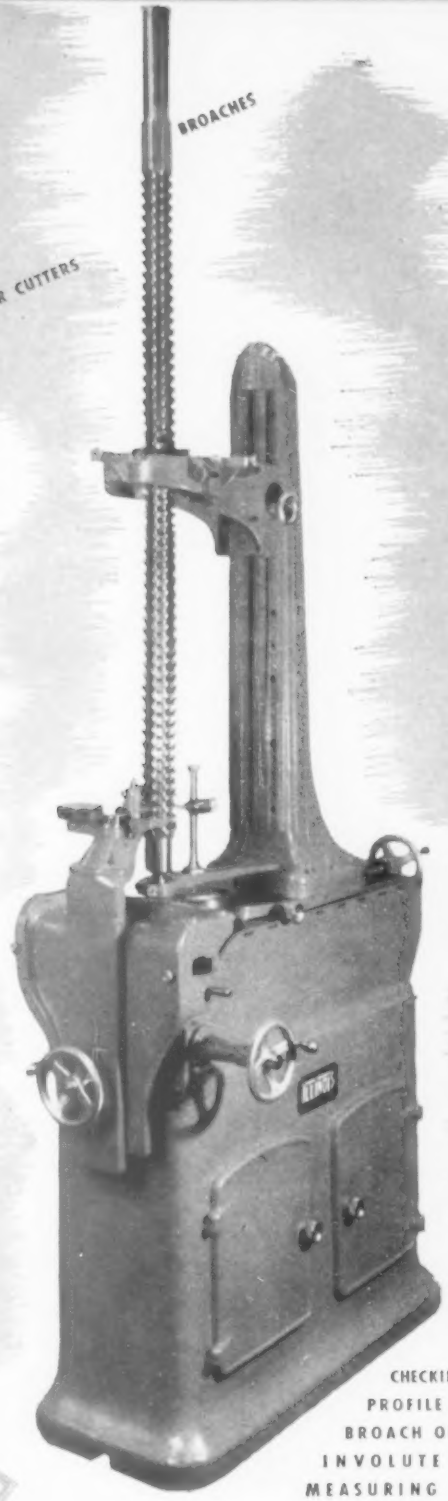
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

HOBS (FROM STOCK)



DISC TYPE SHAPER CUTTERS

SHANK TYPE SHAPER CUTTERS



BROACHES

CHECKING INVOLUTE PROFILE OF SPLINE BROACH ON ILLINOIS INVOLUTE PROFILE MEASURING MACHINE

Complete

INVOLUTE SPLINE TOOLING

to the

NEW AMERICAN STANDARD B 5.15-1946

Illinois Tool engineers helped formulate the basic principles of the new A.S.A. Involute Spline Standard B 5.15-1946 which was officially adopted October 14, and are, therefore, particularly well qualified to discuss its applications and production methods.

Hobs (available *now* from stock), Shaper Cutters and Broaches produced at Illinois Tool, where tolerances and fits can be correlated under the same engineering direction, offer an impartial selection of tooling best suited to your requirements.

All tools are subjected to precise inspection on Illinois Measuring Machines to insure true involute profile. Because Illinois Tool can supply the *complete* tooling—Hobs, Shaper Cutters and Broaches, it is the logical source for your involute spline cutting tools.

Write for this free

Cutting Tool Standards List

Illinois Tool Works Bulletin No. 25 lists the new A.S.A. Involute Spline Standards applying to Hobs, Broaches, and Shaper Cutters.

Write for your *free* copy.

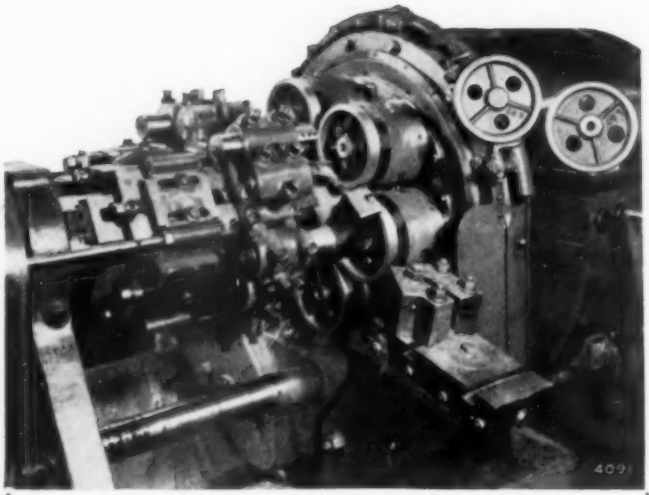
Overnight to all America from the hub of air transportation.

ILLINOIS TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

2501 N. Keeler Avenue, Chicago 39, Illinois

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.

26 Standard GLENCO Compensating TOOL HOLDERS

All Have Interchangeable Parts

From these basic Holders you can make up literally thousands of combinations. All internal driving parts are Standard and will interchange in their particular group or size.

More Combinations Than Alphabet!

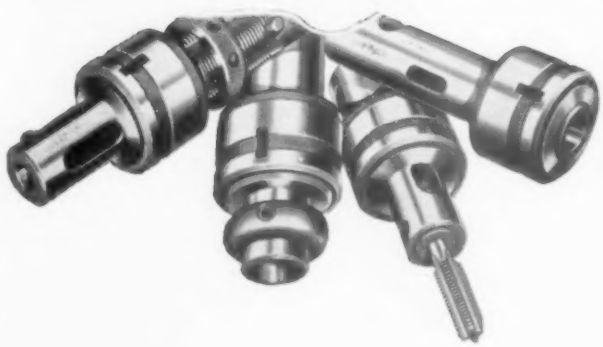
Float sleeves may be interchanged with shanks, or shanks with float sleeves to make up combinations to fit almost any machine or job specifications.

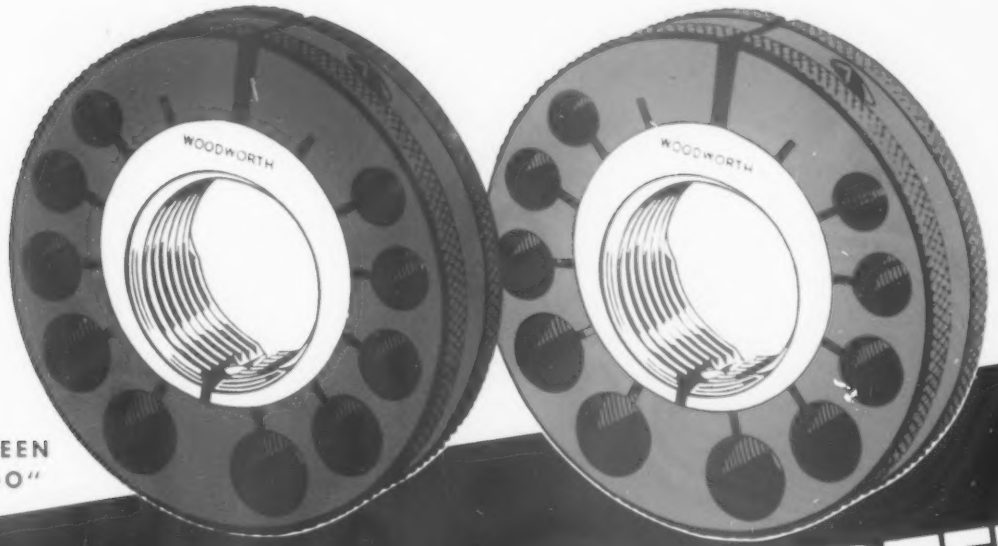
Insure Continuous Perfect Alignment —Correct Misalignment with GLENCO

Illustrated are 9 of the 26 types. Send for complete file of illustrated data sheets Index J, Types A through Z.

Utility Tools

THE J. C. GLENZER CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.





RED
"NOT GO"
Pat. Pending

GREEN
"GO"

NEW TESTED-ACCEPTED THREAD RING GAGES

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH RING GAGES STILL PROVING "ON THE JOB" SUPREMACY OVER ORDINARY GAGES

No wonder more and more industries are adopting this gage as standard. Its revolutionary design assures wear life 5 to 7 times longer. And maintains accurate inspection.

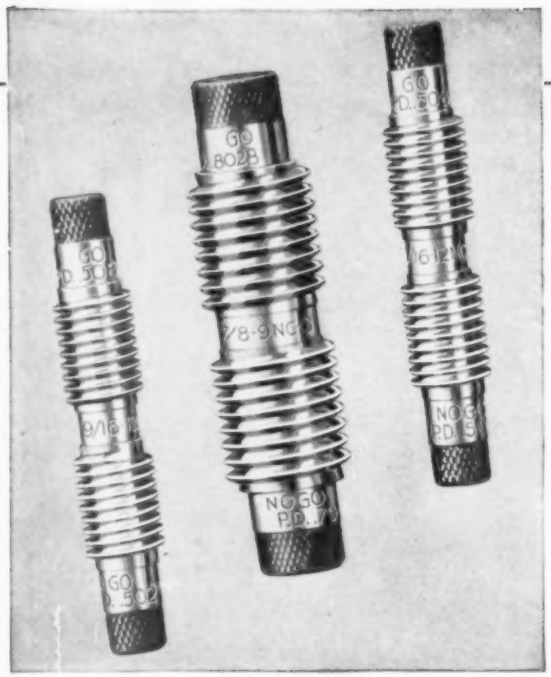
This *proved* gage is easy to adjust, light in weight, durable—it's a *must* for cutting costs, increasing production. Just try the Woodworth Thread Ring Gage on your extra tough job—and you, too, will standardize!

Wire or write for folder No. 46R at no obligation.

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS



THRED-MASTER

Saves TIME AND EQUIPMENT

Each THRED-MASTER consists of a go and no-go section combined in a progressive type gage with knurled handles.

Being round, the THRED-MASTER presents an infinite number of measuring contact points which means greater gaging-life. THRED-MASTERS are made to "Master" gage accuracy and conform to N.S.T.C. standards.

They are easy to use:—Pick out the THRED-MASTER and corresponding measuring wires of the proper size. Set up your amplifier directly by the three wire measuring system.

These measuring standards are ideal for setting up amplifiers (either visual or electric) and for accurately adjusting roll thread snap gages.

Write for price and delivery.

REPUBLIC GAGE

2228 FENKELL AVE.
DETROIT 21, MICH.

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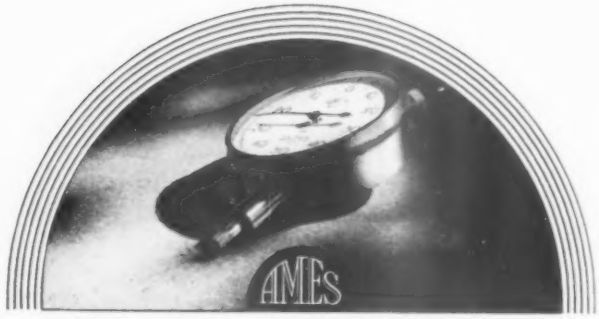

GOOD IN THE 4TH DIMENSION, TOO!

For tool checking or tough production jobs, Ames Dial Indicators are *time*-conserving as well as sensitive and accurate. They're *quickly* mounted and adjusted. Their dials are *instantly* readable. But *most time-saving* is their ability to stay *right* on the job, without internal adjustment—*longer* than any other indicator you can buy. Send for illustrated Catalogue.

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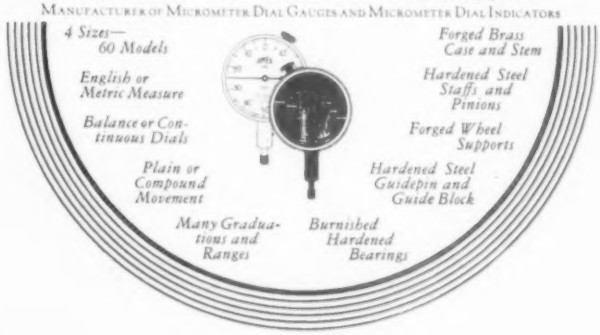

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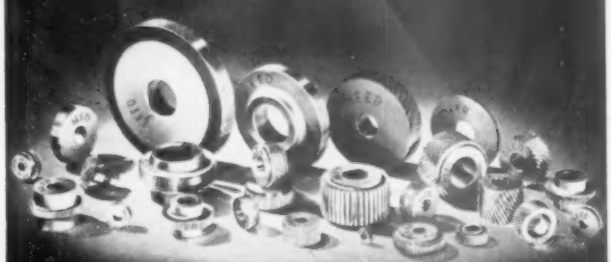

REED ROLLED THREAD DIE CO.

GROUND & LAPPED KNURLS

Prompt Delivery on Standard Knurls
More than 100 Sizes and Styles of REED Standard Knurls in stock in High Speed Steel.
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Knurls - Thread Rolling Dies and Machines

WORCESTER 2, MASSACHUSETTS, U. S. A.

PARKER PM MAJESTIC

Precision Economy Dependability

NO. 2 SURFACE GRINDER

THE 3 ESSENTIALS IN GRINDING MACHINES

With the return from the problems of the war years, and the era of "Buy what you could get and no matter what the cost," to Post War Production, the 3 essentials will be the watchword of prospective buyers of machinery.

The new PARKER-MAJESTIC No. 2 Surface Grinder embodies all the features gained in our forty years of experience, including a positive cross feed saddle locking device and vernier cross feed adjustment in tenths, making it without doubt the outstanding value on the market today. Furnished with either the well-known PARKER single speed motorized spindle, shown in insert, or multiple speed unit giving several speeds, ranging from 2000 to 6000 RPM.

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A companion in value is the new PARKER-MAJESTIC Model "B" External Grinder. Streamlined to present day styling, and with many new features added, makes this machine a leader in its field.

Designing has been so simplified that a novice can become very efficient in its operation in a short time.

"TWO MACHINES IN ONE"

With the quick change-over of spindle brackets shown at right, the new Model "B" can be converted to an Internal Grinder, giving double duty at less cost.

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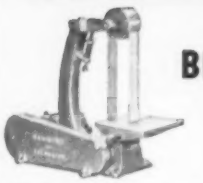

Model VH-6WP Wet-n-Dri 6" belts. Used horizontally or vertically.

Model F-2 Flexible Belt, ½" to 2" belts. Especially suitable for irregular shaped parts.

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Chip Breaker and Diamond Finishing Grinder.

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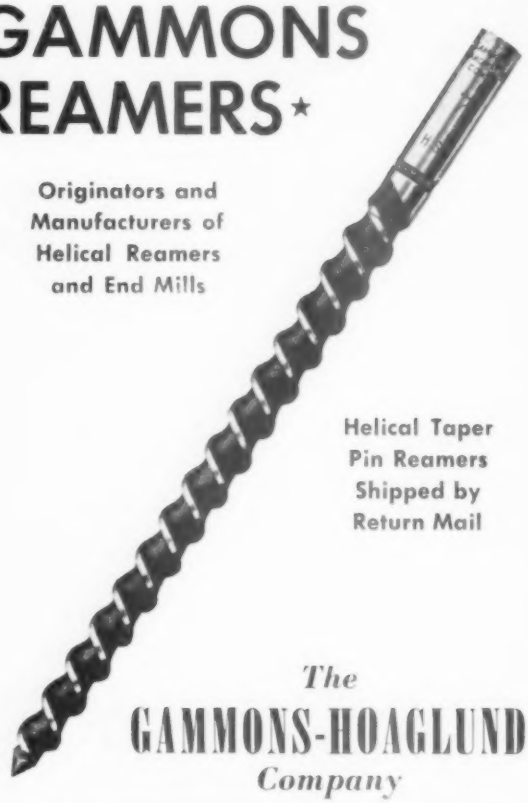
Originators and Manufacturers of Helical Reamers and End Mills



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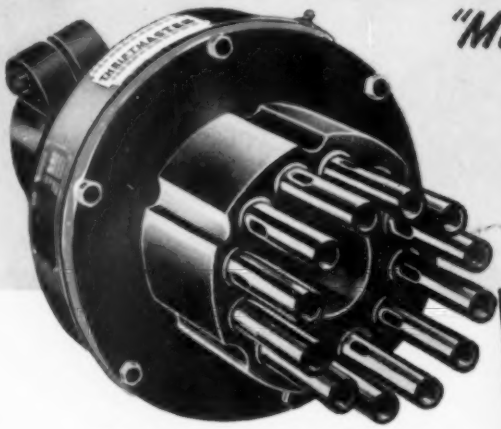

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12 Spindles on fixed centers. *For Drilling, Tapping, Reaming, Counter-sinking, End Milling, Spot Facing, Hollow Milling.*

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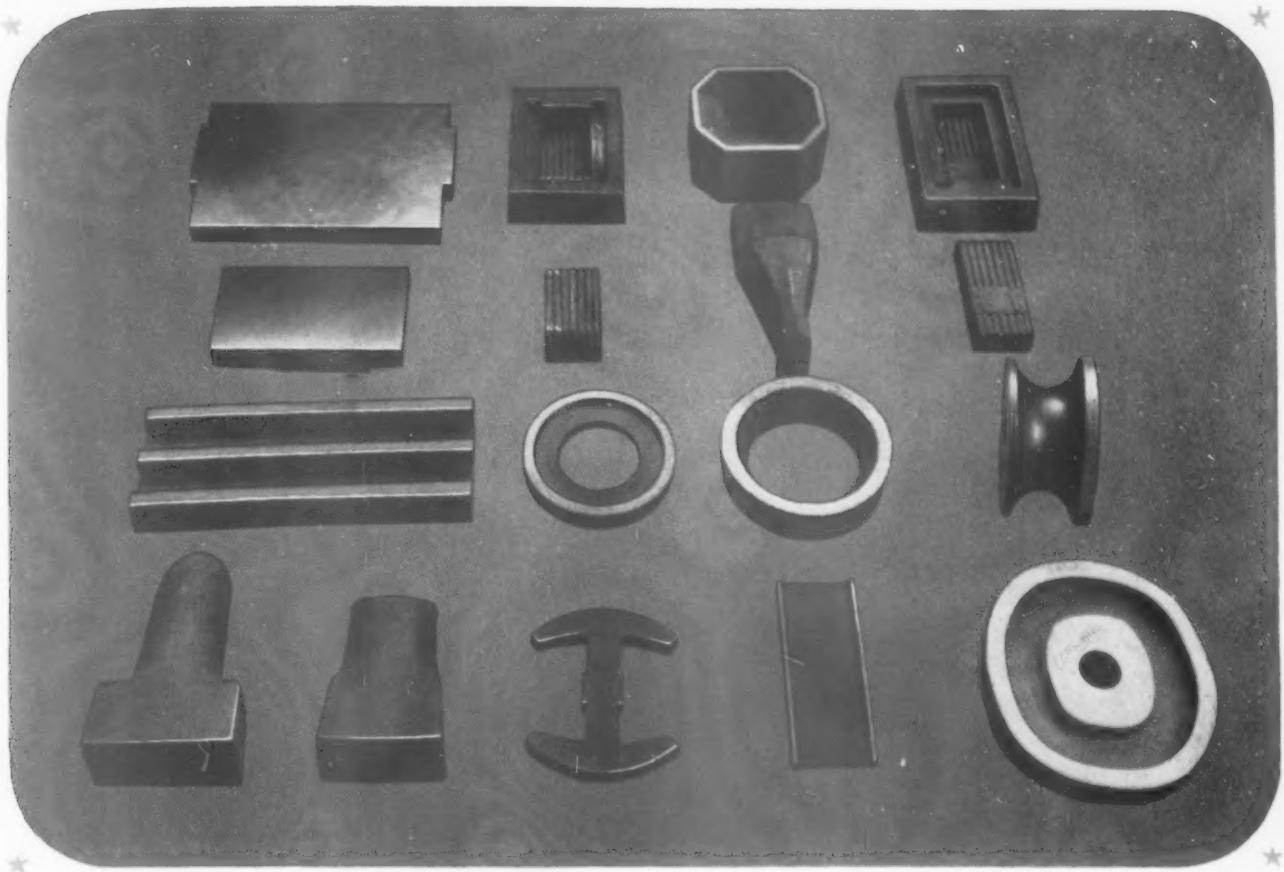

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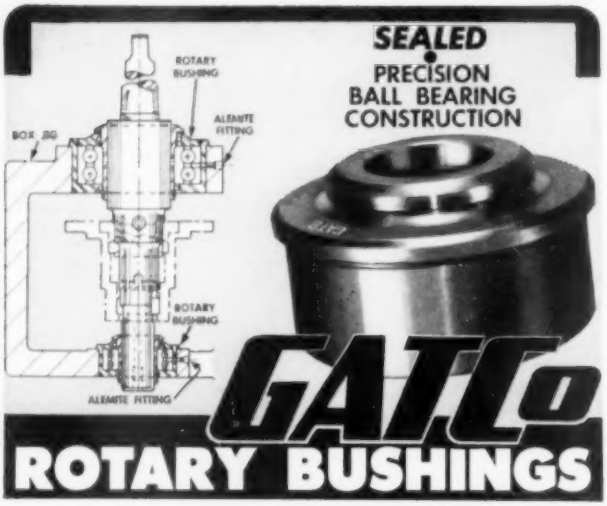

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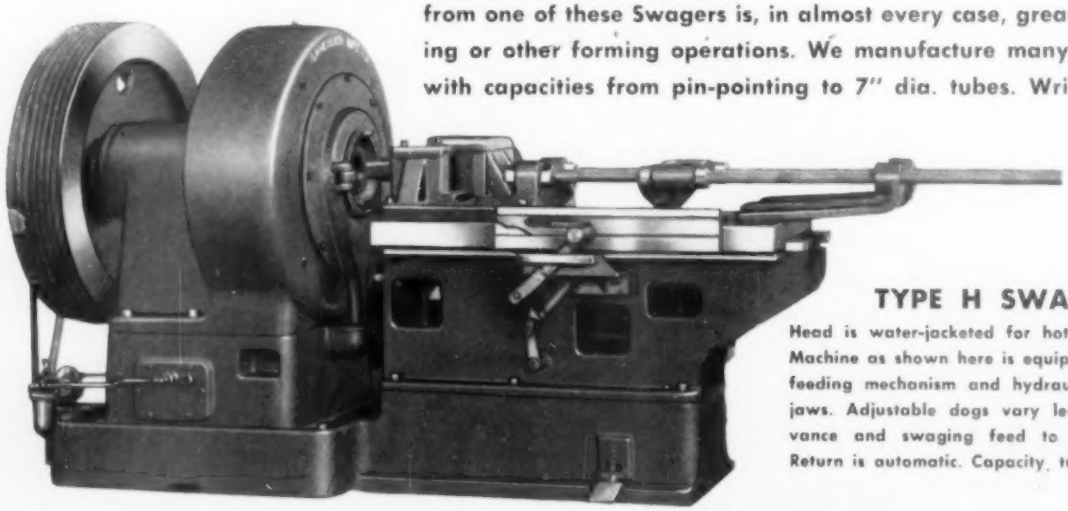

TYPE H SWAGER

Head is water-jacketed for hot or cold swaging. Machine as shown here is equipped with hydraulic feeding mechanism and hydraulic work clamping jaws. Adjustable dogs vary length of quick advance and swaging feed to suit requirements. Return is automatic. Capacity, tubing, 3".

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Ask for the well-illustrated, fully descriptive folder on JARVIS TORQOMATICS. It shows you how to increase quality production at lower cost. WRITE TODAY, Dept. 222, Jarvis Power Tools, Middletown, Connecticut.

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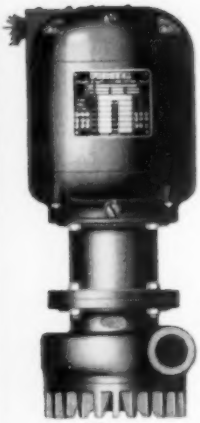

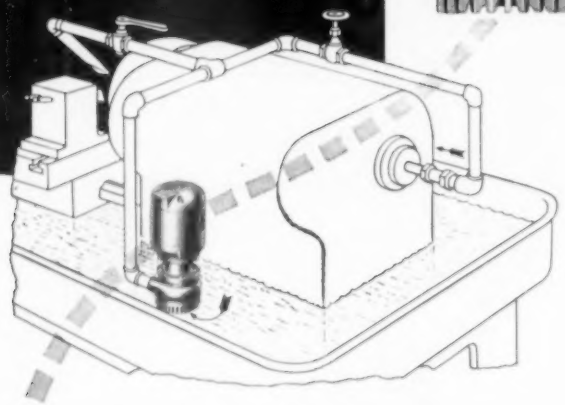

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(Vertical Short)

Designed for Shallow Chip Pans Without Covers

Here is a performer with nine lives . . . it will give years of service . . . easily and quickly installed either with new equipment or as replacements . . . the inlet grille serves as a base, allowing the pump to rest directly on the bottom of the tank . . . clamps and holding brackets are not required.

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To Choose From

Pioneer Pumps in Seal-type, Seal-less and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every type and size. Please describe your installation when writing for information.

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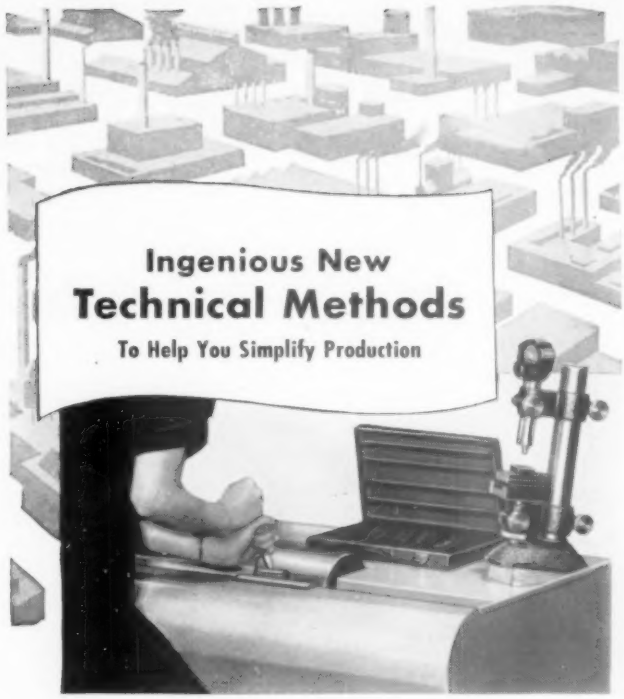


New Centerless Lapping Machine Gives Precision of Less Than 2 Micro-Inches!

Now it's easy to lap cylindrical pieces—quickly—accurately—without specialized operator skill! The new Size Control Centerless Lapping Machine handles pieces from .010" to 10" diameter without costly set-ups.

Centerless Lapping Machine

The operator merely holds piece between lapping rolls with stick. Pressure applied determines quantity of metal removed. Small roll turns piece at slow constant rate. Large roll turns more rapidly to remove minute quantities of metal. Ideal for lapping oversize gages, worn gage plugs to next smaller size, bearings, bushings or shafts. Roll speeds easily changed. Adjustable for tapers.

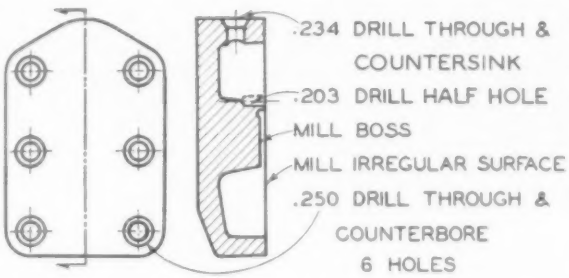
Ideal also to save time on the job, is chewing gum. The act of chewing aids the workers' concentration; seems to make work go easier. Furthermore, chewing gum may be used even when both hands are busy—increasing worker safety—and reducing work interruptions. That is why many plant owners have made Wrigley's Spearmint Gum available to all.

You can get complete information from Size Control Company 2500 Washington Blvd., Chicago 12, Ill.

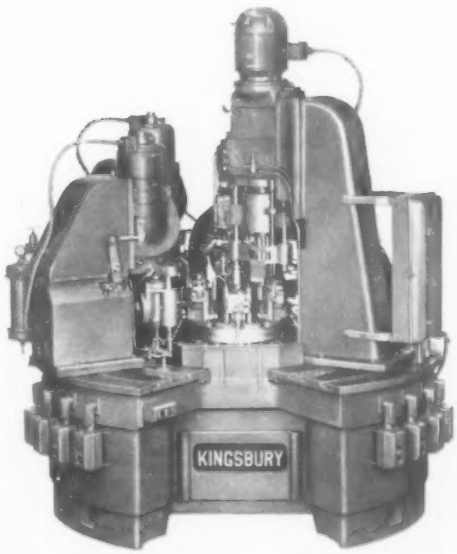
AB-55

Multiple Drilling for High Production

Problem Machine cast iron cylinder heads on three sides. The boss must be perfectly flat.

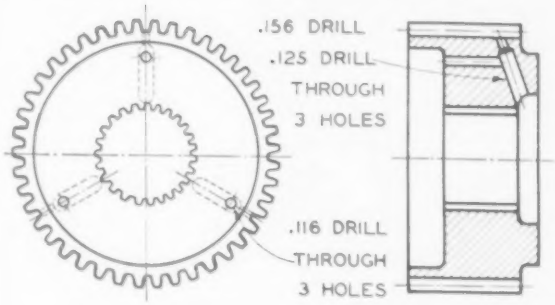


Method THE BOSS BELOW THE IRREGULAR SURFACE is end milled by a cutter that moves toward the work, then upward for the cut and away. Six identical fixtures on the index turret each hold two pieces, one in front and one on top. The front piece is machined first. It is then transferred to the top location for counterboring on the opposite side.

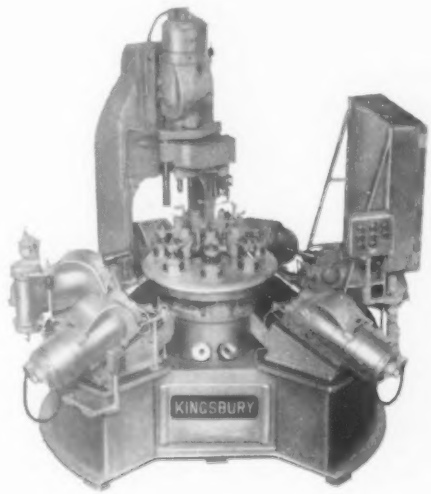


Results 295 PIECES PER HOUR GROSS with one operator, plus savings in handling time, floor space and rejects. All together, they lower the unit cost enough to pay for the machine in a short time.

Problem Drill holes in cast iron clutch hubs 120° apart and central with gear tooth space.



Method ALL SEVEN FIXTURES ROTATE 120° with each index of the turret to space the angular holes equally. Six units working upward through the fixtures drill these holes in two steps. A vertical unit with a three-spindle head drills the parallel holes.



Results 210 PIECES PER HOUR GROSS WITH ONE OPERATOR.

For your high production work get the facts on automatic machinery and compare unit costs. If multiple drilling operations (requiring up to five H. P. each) are involved, we can design, build and tool machines ready to work for you. To obtain proposals, send us the prints showing the operations and hourly production.

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MILLING MACHINE

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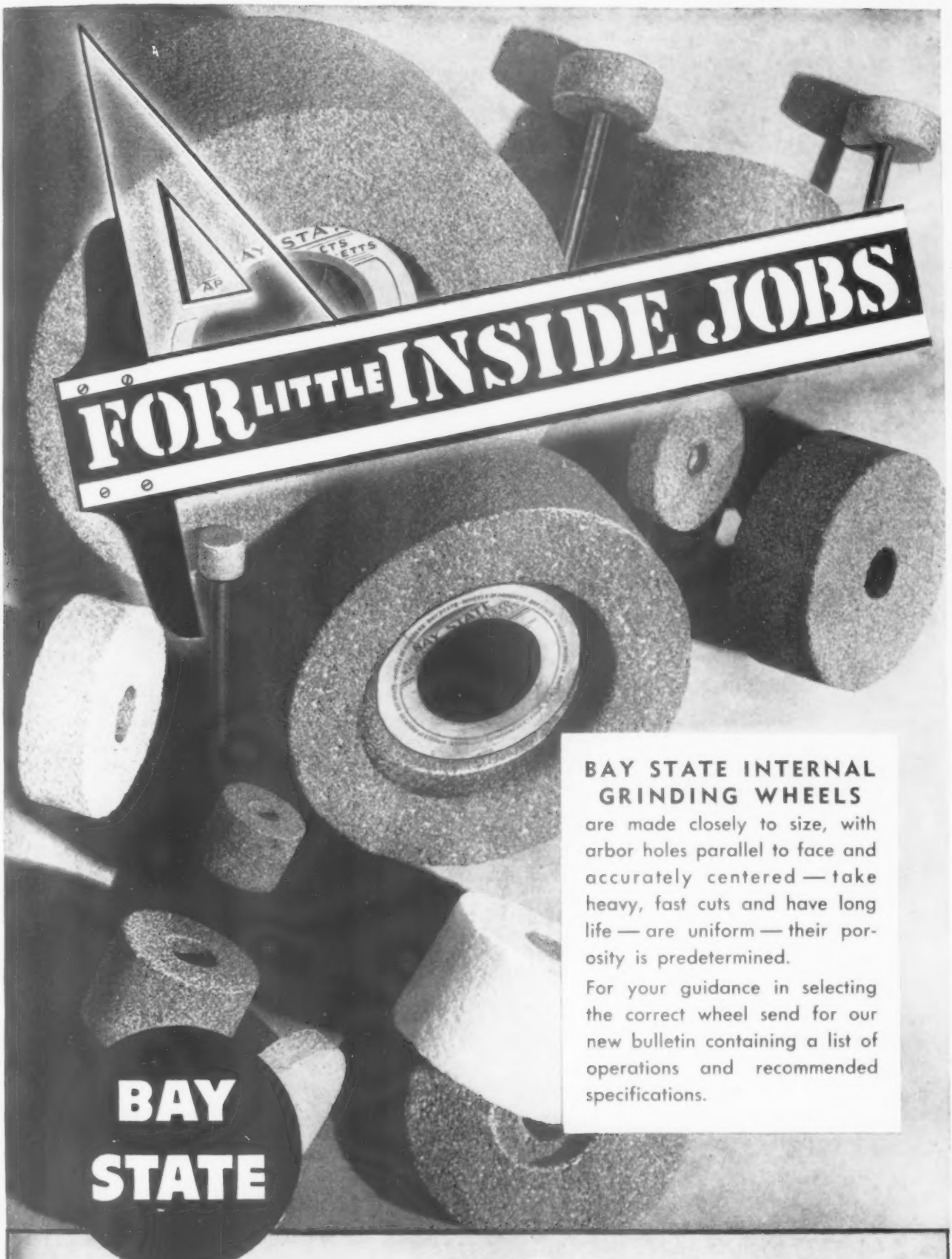
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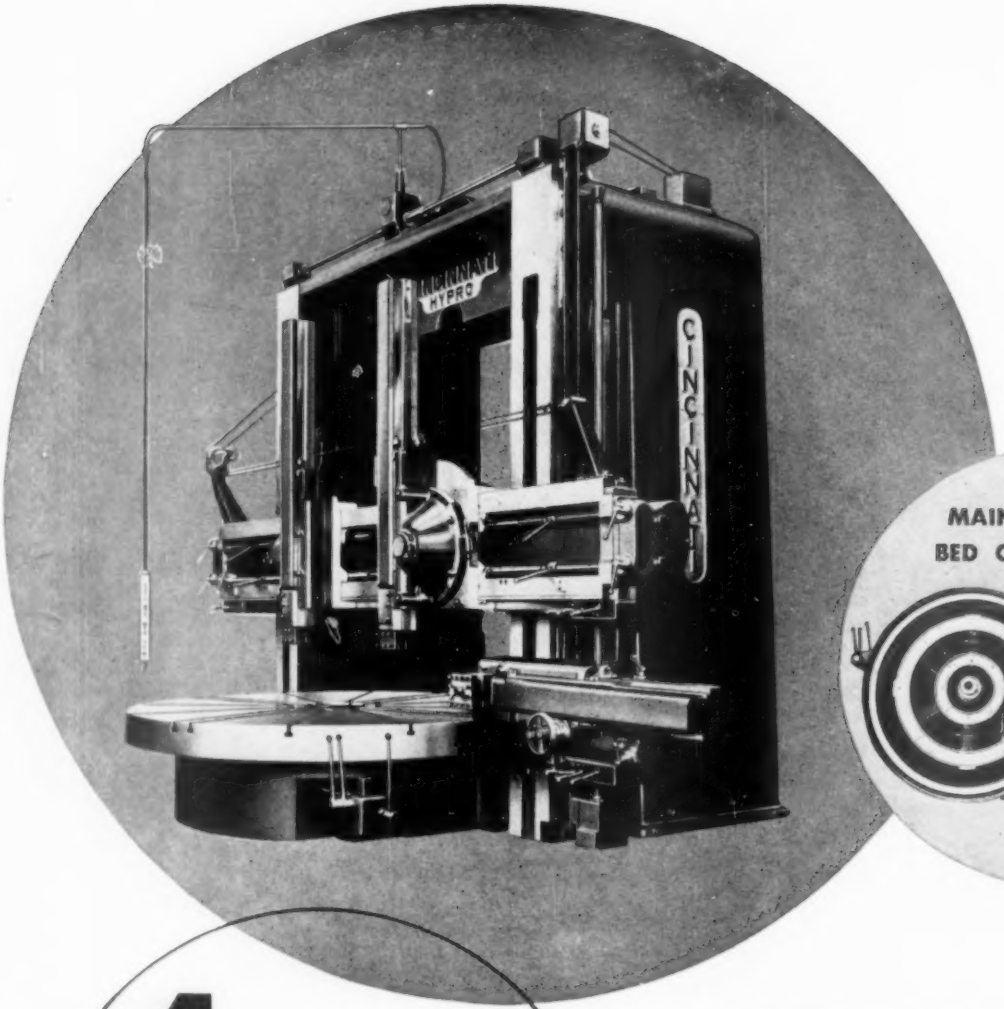

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1. One piece speed box and bed construction, providing rigidity and preventing misalignment of shafts
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3. Anti-friction bearing table mounting with 3 load carrying tracks; outside track nearly full diameter of table
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THE CINCINNATI HYPRO PLANER COMPANY

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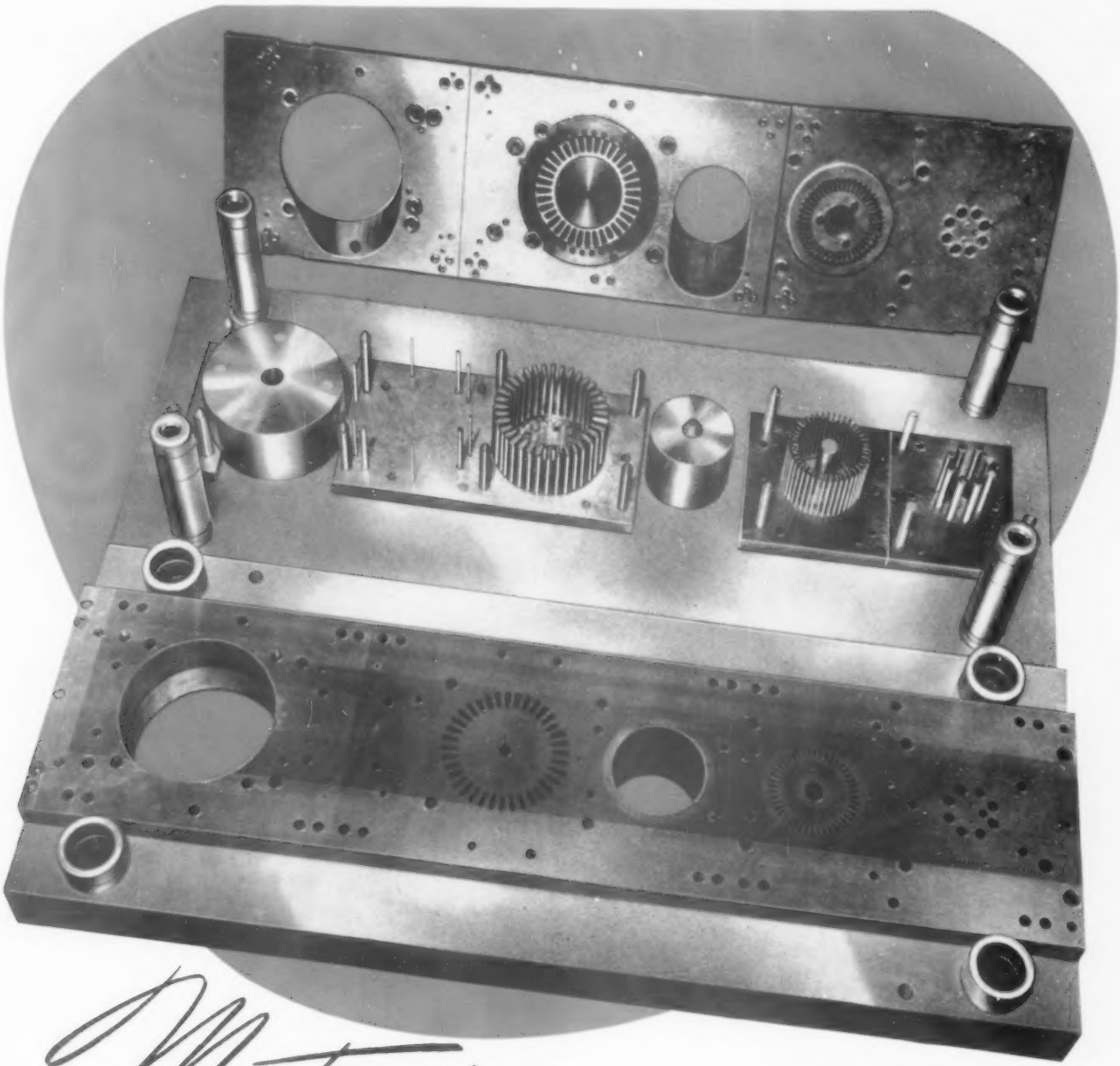

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100,000 pieces per grind . . . 100% increase in production over former dies . . . is the outstanding performance of this Cromovan six station, progressive lamination die. The die punches out both rotor and stator laminations complete . . . from .025 silicon lamination sheets . . . clearance tolerance of .0007 inch per side is strictly maintained between punches and die. All cutting surfaces of this die are made of CROMOVAN.

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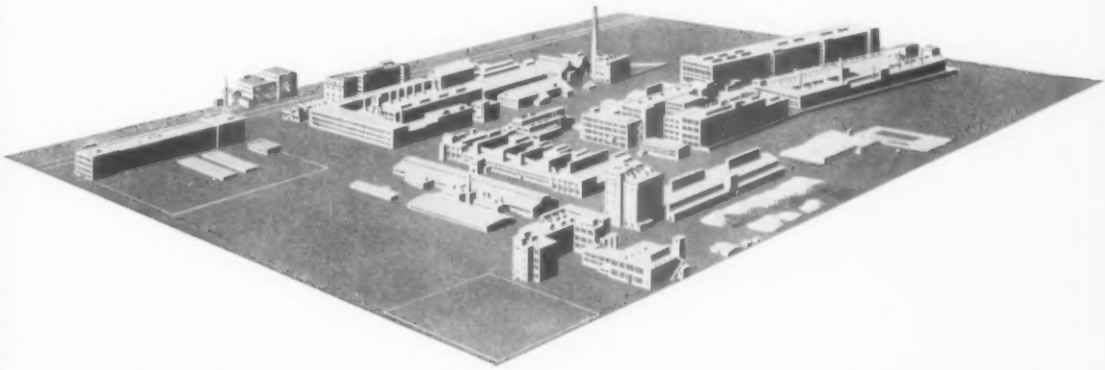
A BUYING GUIDE FOR ABRASIVES

POINT No. 1

MANUFACTURING RESOURCES



It is understandable to anyone in Production that better manufacturing resources generally lead to a superior product. Quality is not to be had for the mere wishing. The vast manufacturing facilities of The Carborundum Company are known to be an important part of the nation's industrial picture, and are pointed to as being in the forefront of manufacturing and technical progress. Not the least of the reasons for the satisfying, uniform, and dependable quality of Abrasives by CARBORUNDUM are the spacious, modern, alert and efficient manufacturing facilities which produce those abrasives. The Carborundum Company, Niagara Falls, N. Y.

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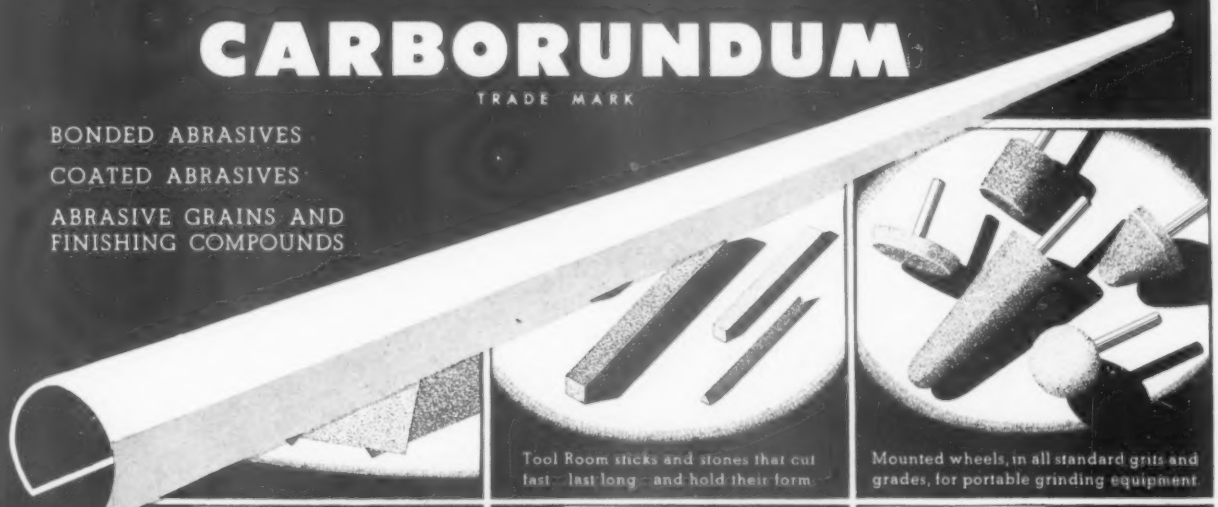

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Mounted wheels, in all standard grits and grades, for portable grinding equipment.

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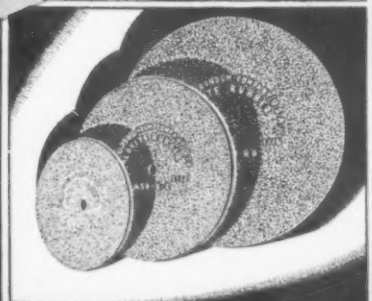
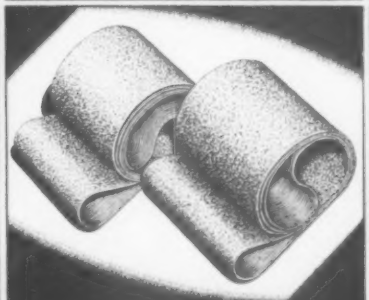
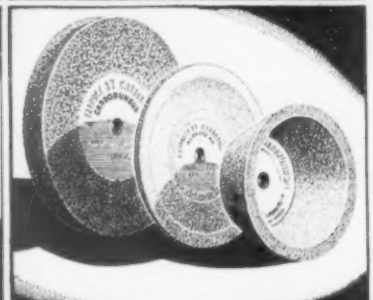


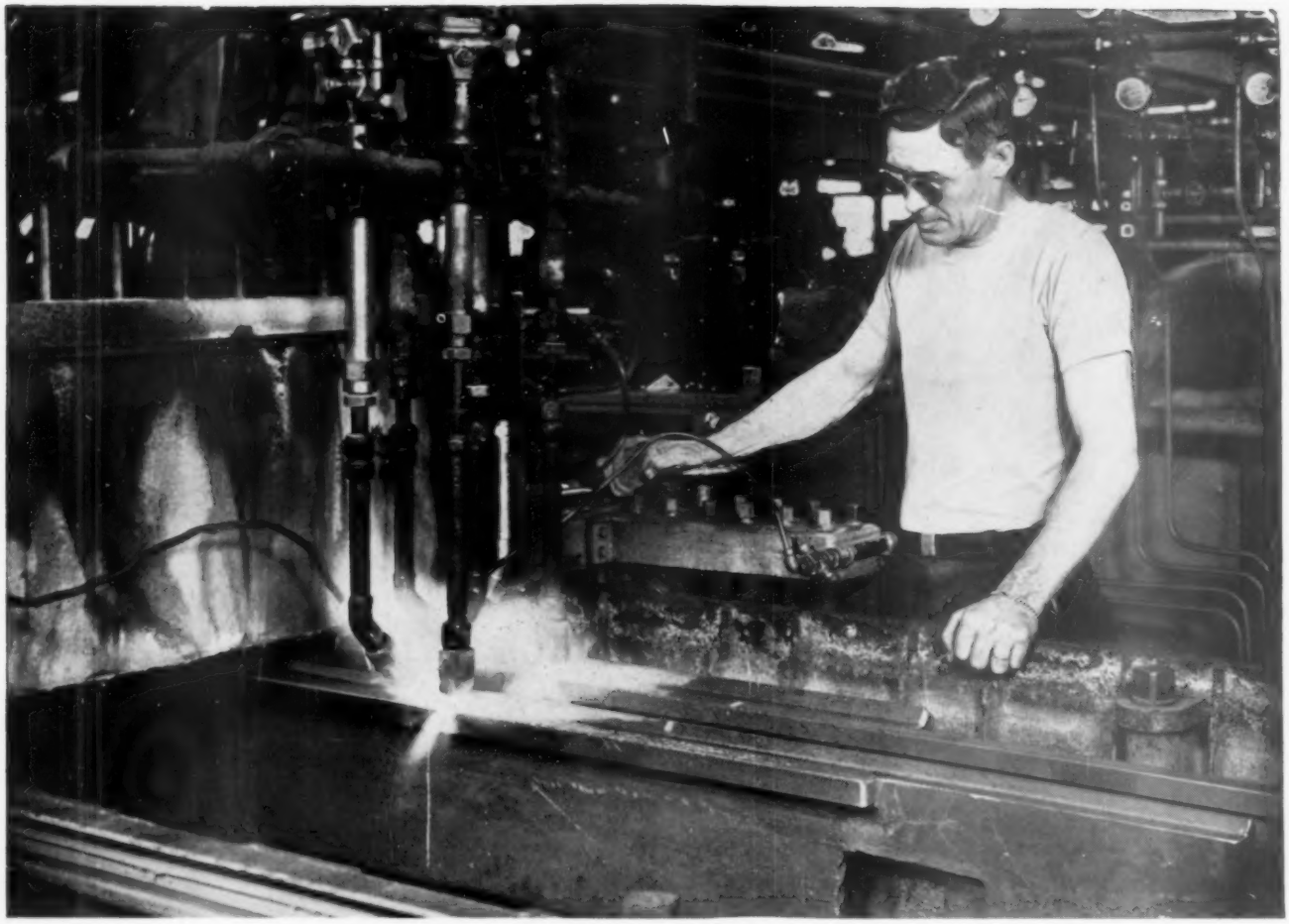
Cutting-Off Wheels . . . the modern tool for faster, less costly, more finished cuts.



A Coated Abrasive for every sanding and finishing condition.



All standard shapes are supplied in grinding wheels by CARBORUNDUM.



This Flame Hardening Keeps Monarch Lathe Ways "*Good as New*"—EVEN AFTER 1,090,000 CYCLES

"*. . . This fine tool was used in shell manufacture and during its time in use, approximately one year, turned the burr ring on one million, ninety thousand shells. In examination of the machine, we find the ways as good as new although the movement of the carriage was confined to a short space. This seemed amazing to us after our experience with the older types of construction.*"

That's unsolicited, written testimony about a standard Monarch 10" EE Toolmaker's Lathe. What wasn't known is that such performance records are the *accepted*, rather than amazing, experience—for thousands of Monarch users everywhere.

More than 21,000 lathes have left our plant with flame-hardened ways since we first introduced the process for machine tool applications, back in 1937. It's one of the many plus features of Monarch Lathes—features that enable you to produce more for less. We'd welcome the opportunity to show you how Monarch can meet your metal-turning needs. May we talk it over?

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, O.

ACCURACY · ECONOMY · LONG LIFE

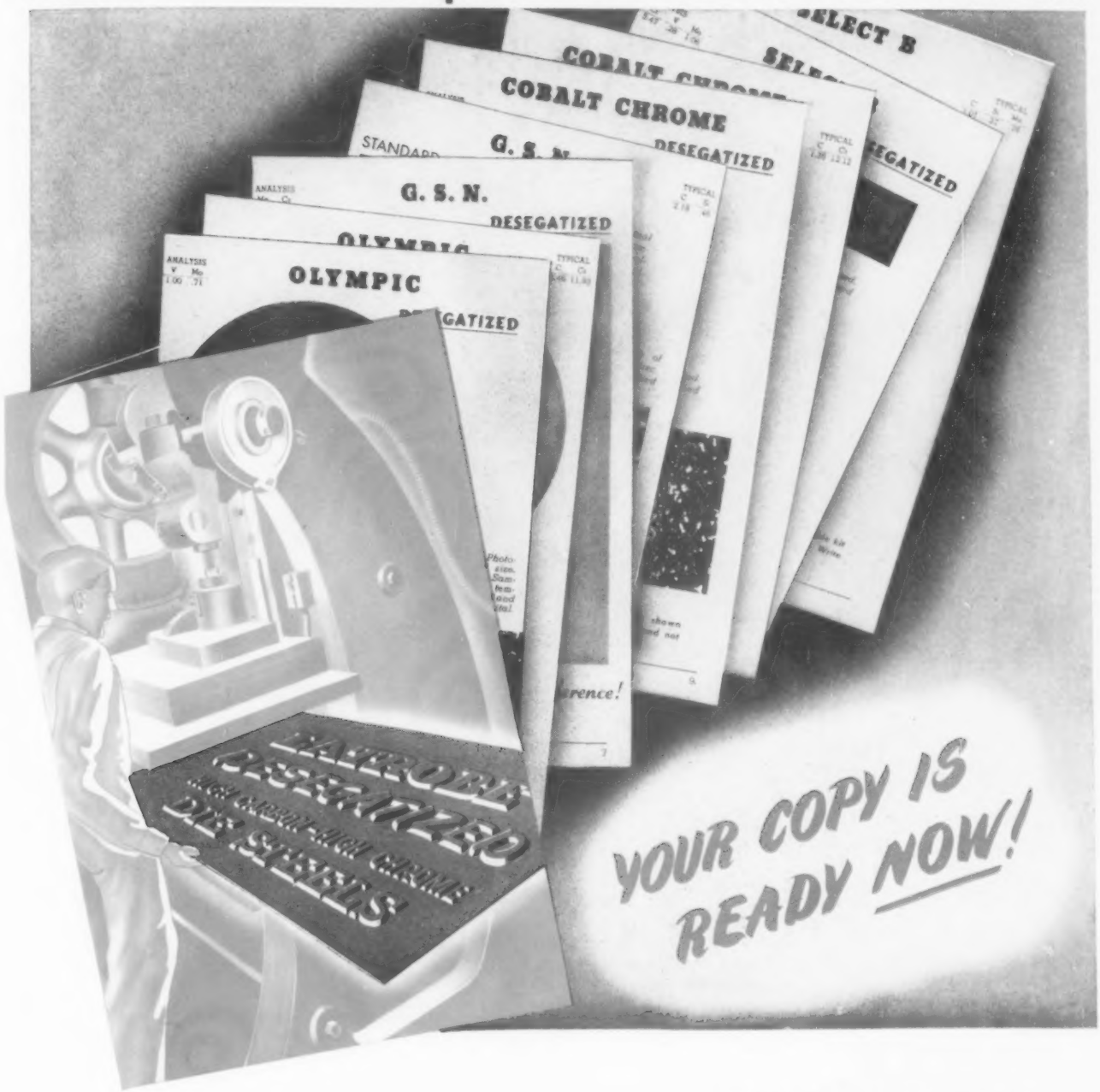
Monarch TURNING MACHINES

10"EE TOOLMAKER'S LATHE

Flame-hardened ways are one important reason why you'll get longer life and greater accuracy in this sensitive precision machine. For complete information and detailed specifications, ask for bulletin No. 10-EE.

YOUR PROOF OF PROTECTION— FOR LONGER LATHE LIFE

• Here's the inside story of another application of Latrobe's DESEGATIZING process...*this time to Die Steels*



THE four grades of Latrobe's High Carbon-High Chrome Die Steels, now made with the exclusive *Desegatizing* Process, are described in this new booklet, just off the press!

In it you'll find page after page of interesting photographs and photomicrographs of both standard and *Desegatized* Die Steels, giving you an opportunity to compare and see the difference. Every buyer of die steels should have a copy. Write today.

LATROBE
DESEGATIZED
High Carbon · High Chrome
DIE STEELS

LATROBE ELECTRIC STEEL COMPANY • LATROBE, PENNSYLVANIA

Specify MO-MAX HIGH SPEED STEELS for all of your CUTTING and TURNING TOOLS

Because only MO-MAX GIVES YOU *ALL* THESE ADVANTAGES...

1. MO-MAX has superior cutting qualities.
2. The machinability of MO-MAX is unexcelled.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.
4. MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.
5. For 14 years MO-MAX has demonstrated its superiority in all types of cutting tools.

Learn all the facts! **Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.**

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corporation
"MOHICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Company
"MO-CUT"	Braeburn Alloy Steel Corporation
"STAR MAX"	Carpenter Steel Company
"MOLITE M-1"	Columbia Tool Steel Company
"REX T-MO"	Crucible Steel Company of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Hulcomb Steel Company
"MOGUL"	Jessup Steel Company
"TATMO"	Latrobe Electric Steel Company
"MIDMAX"	The Midvale Company
"S. T. M."	Simonds Saw & Steel Company
"MO-TUNG"	Universal-Cyclops Steel Corporation
"B-N-2"	Vanadium-Alloys Steel Company
"VUL-MO"	Vulcan Crucible Steel Company

THE CLEVELAND TWIST DRILL COMPANY

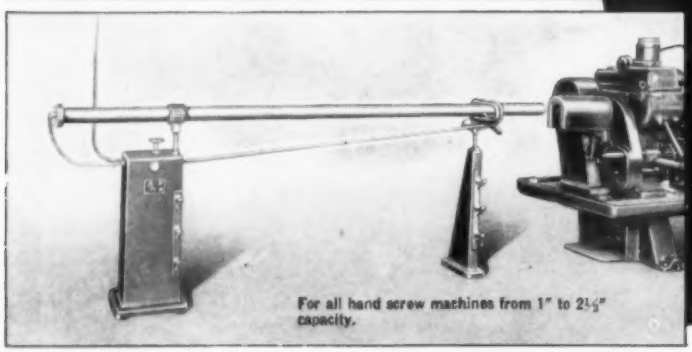
1248 East 49th Street • Cleveland 14, Ohio

Ease Speed Accuracy
GET ALL THREE WITH
UNIVERSAL BORING CHUCKS
UNIVERSAL ENGINEERING CO.
For boring operations in boring mills, milling machines and screw machines, the Universal Boring Chuck assures fast, efficient production with fewer chances for error. For example, centering and drilling operations can precede boring in the same set-up because a button, mounted in slide and ground at same time as flat on side of chuck, provides a reference point for returning collet to dead center Feed screw dial can be adjusted to zero setting in any position in feed range, and anti-backlash screw assures .0005" accuracy in setting which is then positively held by offset slide lock. Available in straight or taper shanks to accommodate boring bars from 3/8" to 1" diameter. You can count on easier, faster, more accurate boring when you use Universal Boring Chucks. Write for complete particulars.
UNIVERSAL ENGINEERING CO.
NMUTH, MICHIGAN

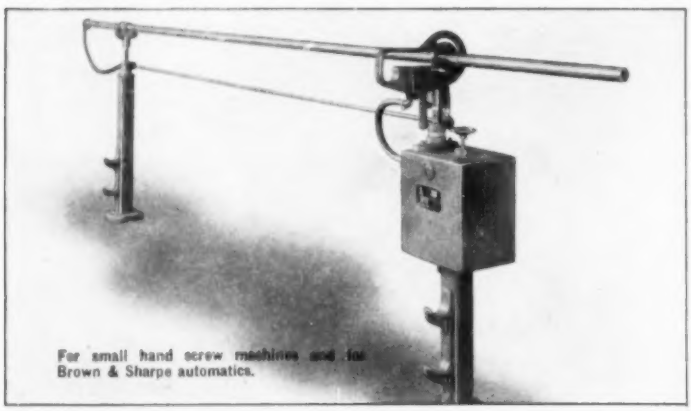
NOW! BAR FEEDS For ALL Types and Sizes of Screw Machines

Standard or Special

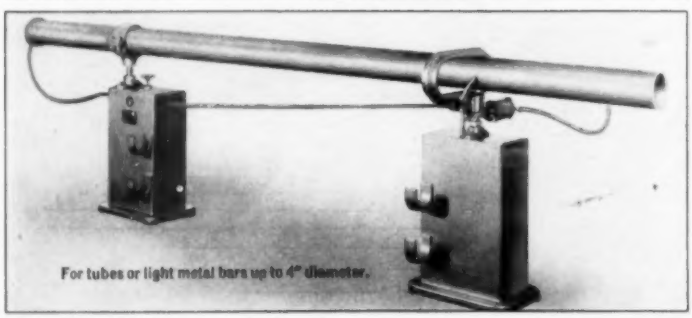
LIPE *Pneumatic* BAR-FEEDS



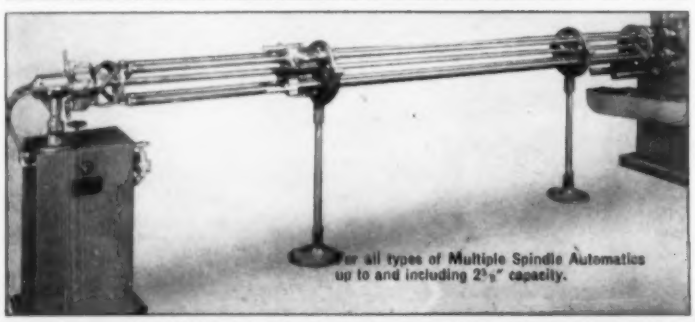
For all hand screw machines from 1" to 2½" capacity.



For small hand screw machines and for Brown & Sharpe automatics.



For tubes or light metal bars up to 4" diameter.



For all types of Multiple Spindle Automatics up to and including 2⅝" capacity.

● Step by step Lipe-Rollway has developed pneumatic bar feeds that can be used on any screw machine, regardless of type or size. The experience and success behind the original Lipe equipment for hand screw machines, first used in 1941, has led to even more startling developments for use with machines handling large diameter stock and for Multi-Spindle Automatics.

INCREASE YOUR SCREW MACHINE OUTPUT and IMPROVE THE QUALITY

When Lipe Pneumatic Bar Feeds are used, feed fingers, pushers and all related parts are discarded, resulting in substantial savings in replacements and repair costs. Higher production rates result from no lost time in operation and maintenance of feed fingers. No set-up is required when jobs are changed. And that's not all!

Lipe Pneumatic Bar Feeds reduce your scrap loss . . . entire bar is enclosed, protected, and supported at both ends . . . no whipping . . . no surface contacts at any time to mar or scratch fine finish . . . noise reduced almost to vanishing point . . . no special guards required. Safe—sure—simple—and quiet.

Write today for further information about Lipe Pneumatic Bar Feeds . . .

Lipe-ROLLWAY CORPORATION, Syracuse 1, N. Y., U.S.A.
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Advantages of Famed Swiss Precision for American Production

IF you are working to tolerances of "quarter tenths" on a production basis, Swiss high precision machine tools and measuring instruments will give you the unusual advantages of highest accuracy, convenience of operation, ease of control and exceptional versatility — factors that spell new proficiency and new economy on even the most exacting jobs.

All these advantages of famed Swiss precision are obtainable through the Cosa Corporation, headquarters for the following Swiss Machine Tools and Measuring Instruments: SIP Jig Borers, including the Hydroptic-B Jig Boring and Milling Machine, with its built-in optical measuring system . . . SIP Profile Projectors, Dividing Machines and Measuring Instruments . . . Studer Profile Grinders . . . Bechler Automatic Lathes and Screw Machines . . . Mikron Gear Hobbing Equipment . . . Safag Automatic Pinion and Wheel Cutting Machines . . . Sallaz Burnishing Equipment . . . Schaublin Turret and Finishing Bench Lathes . . . Lienhard Pantographs, 3-dimensional Copying and Milling Machine.

Our engineers are familiar with all the many possible applications of the advantages of these world-famous Swiss Machine Tools and Measuring Instruments. They will be glad to work with you in specifying and using them to your best advantage.

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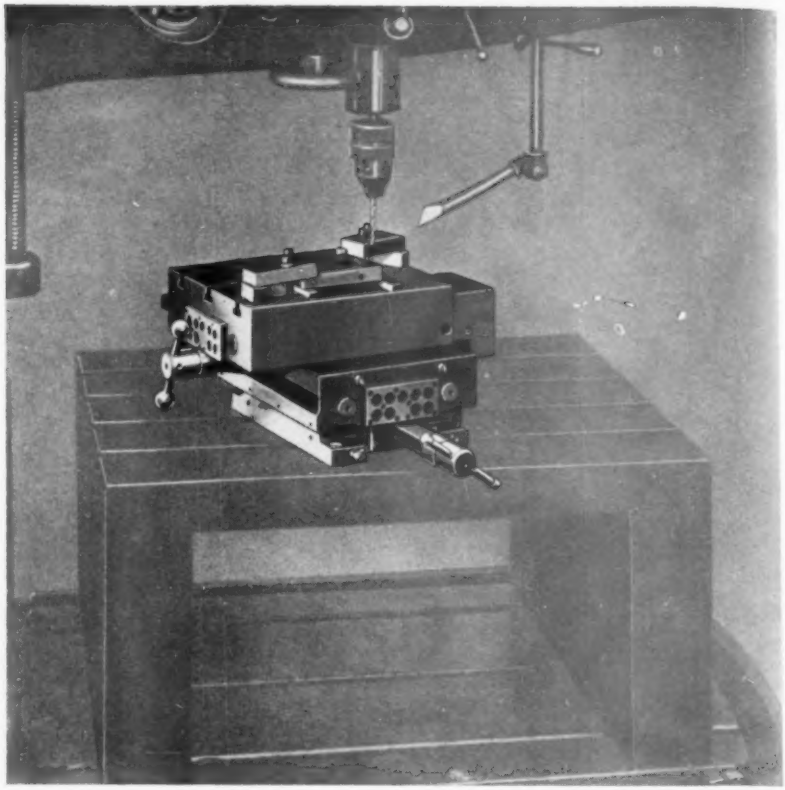
NOW...

without JIGS

. . . . you can drill, bore, ream and tap . . . small work

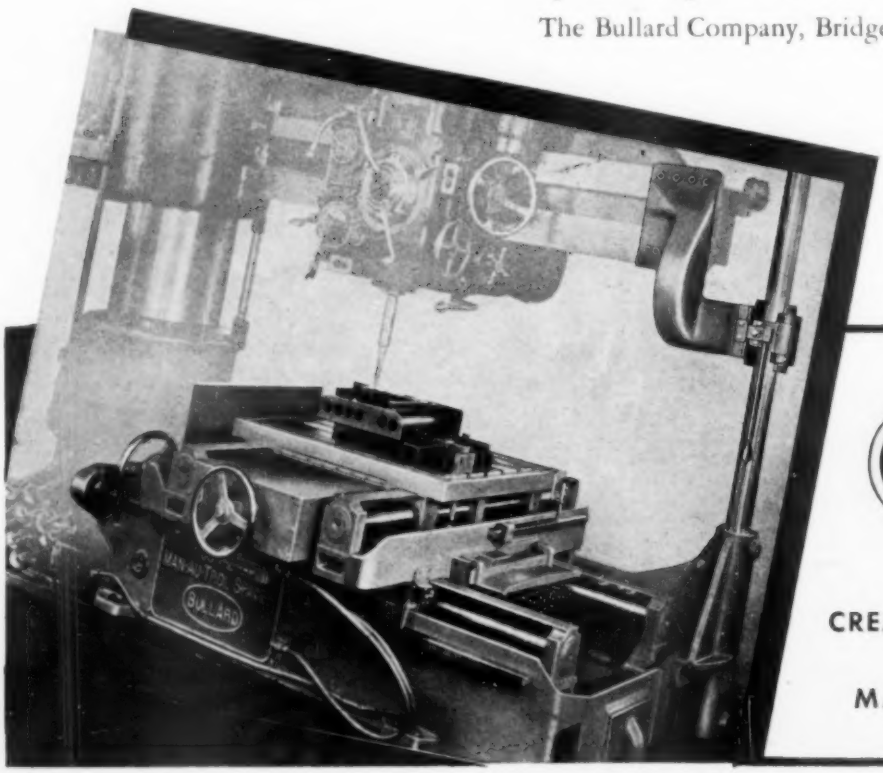


The new 4″x 4″ Bullard MAN-AU-TROL Spacer for speedily and accurately locating holes within a 4″x 4″ area . . . for use on smaller sensitive drills but usable on larger drills as shown. Its hydraulic unit will operate four 4″x 4″ Spacers if you so desire.

. . . as well as LARGE WORK

The new 30″x 20″ Bullard MAN-AU-TROL Spacer for accurately repeating a pattern of holes within a 30″x 20″ area . . . for use on radial drills.

BOTH the 4″x 4″ and 30″x 20″ Bullard MAN-AU-TROL Spacers give you such benefits as: elimination of expensive jigs . . . no production tie-ups for making jigs . . . straight holes 90° to the work . . . prevention of strain on drill spindle and reduction of drill wear because of perfect tool centering . . . less operator fatigue. Write for MAN-AU-TROL Spacer Bulletin. The Bullard Company, Bridgeport 2, Connecticut.



Typical Installation of 30″x 20″ MAN-AU-TROL Spacer.

BULLARD

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

It's FREE

THE NEW LOVEJOY "CUTSALL"

Catalog Describing Tool-Bit Type Carboloy-Tipped Milling Cutters

Here is a brand new Lovejoy catalog filled with facts about Lovejoy's great new Cutsall Face and Step milling cutters. They are designed to profitably meet the most modern production demands. They have such features as interchangeable Carboloy tipped blades, rugged forged steel housings, provision for fine blade adjustment and secure blade locking. And in action they remove metal faster and cleaner than anything you've ever tried. It will pay you to fill in the coupon and mail it to Lovejoy today.

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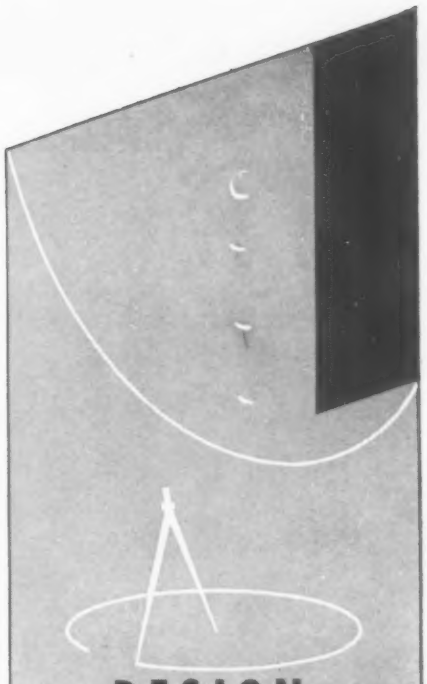
LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.



DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.

RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

ARE YOU REORDERING OBSOLETE BROACHES?

A broach performing satisfactorily right *now* can often be redesigned to increase production, improve finish and eliminate operations.

The above *redesigned* broach did just this. Now it produces the 1″ hole in an aluminum casting to a 10 micro-inch mirror finish. Eliminates reaming, grinding and honing.

Let us check your prints for up-to-the-minute design *before reordering*.

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LET MICHIGAN FURNISH YOUR PRODUCTION PARTS *Completely Machined!*

With the largest production machine shop of its kind, Michigan will machine your production parts, complete, *assuming "undivided responsibility", for the engineering, tooling and production.*

Parts like these are machined by Michigan.

Get Michigan's quote and check costs. Michigan may be able to save you money and headaches.

Do you have our 9 folders on broaching?

MICHIGAN BROACH CO.

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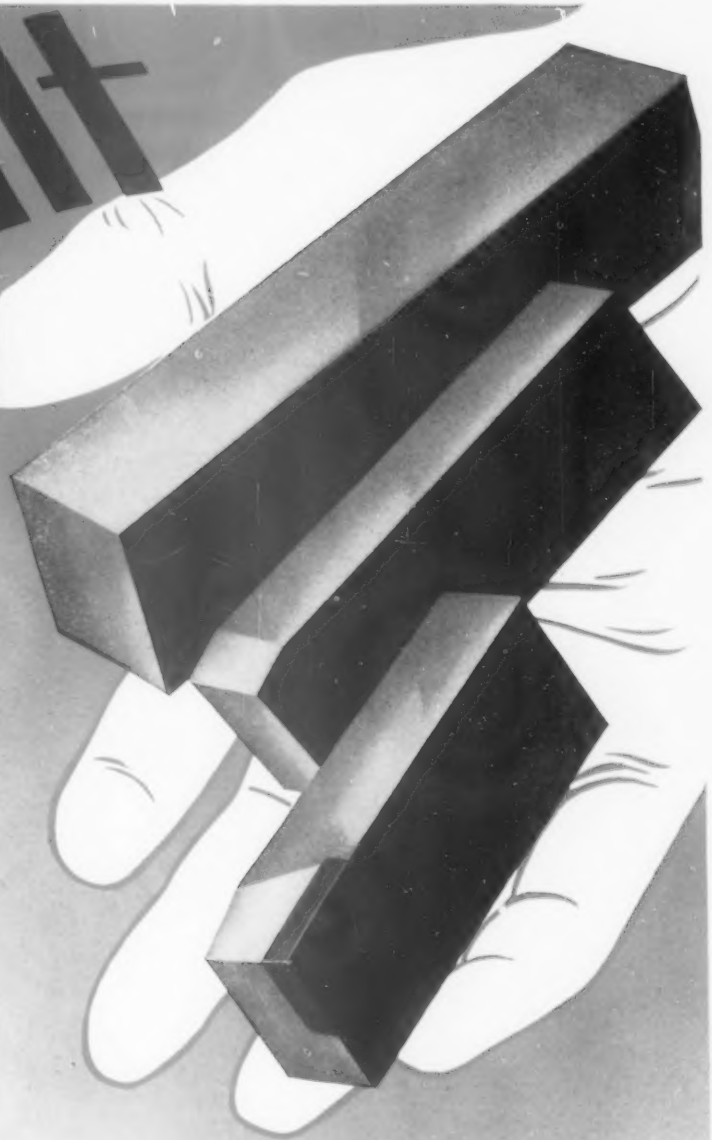
Crobalt Quality



Crobalt is a hard alloy (containing principally chromium, cobalt, tungsten, vanadium, zirconium and carbon), cast in the form of tool bits and inserted milling cutter blades especially developed for high speed production. At high temperatures (up to 2000 degrees) Crobalt cutting qualities remain constant.

The cutting edges of a Crobalt tool stay sharp longer, and thus assure you of much greater tool life between grinds. This automatically increases production by reducing "Down-time" ordinarily required for changing of tools. Try Crobalt in your shop.

CARBIDE TIPPED
Inserted Milling Cutter Blades

Crobalt now fabricates carbide tipped inserted milling cutter blades. Any make of tungsten carbide can be furnished. Prices for this type of blade are unusually low and the product and finish are unexcelled. We manufacture blades of all types and sizes. Send us your prints for quotation.

Crobalt Inc.

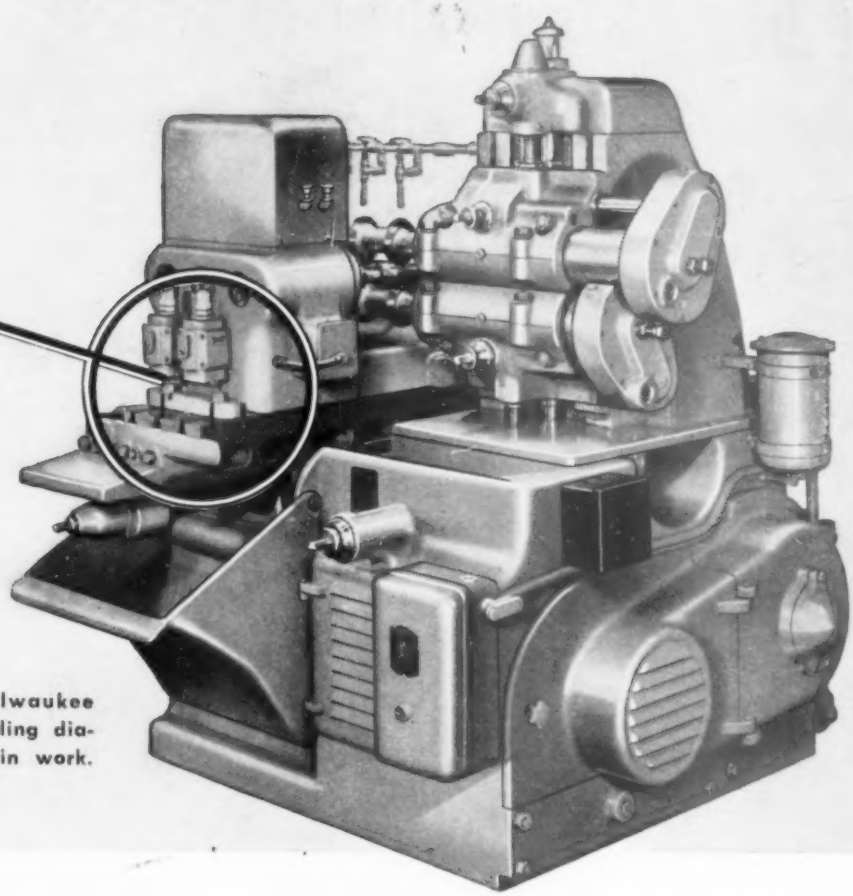
1351 N. Main St. Ann Arbor, Mich.

VICKERS HYDRAULIC CONTROLS

Simplify Machine Operation... *Protect* Work and Machine

Vickers Hydraulic Sequence and Check Valve.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.

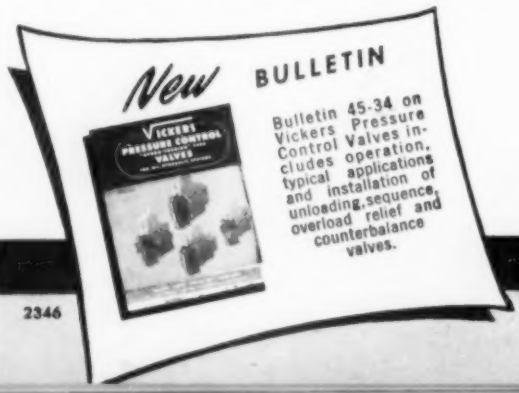


Kearney & Trecker Milwaukee Simplex for multiple milling diametrically opposite slots in work.

This is a representative installation of Vickers Hydraulic Controls featuring interlocking of machine operating phases by a combination of pilot interlocks and pressure sequence control valving. Three work arbors are indexed to position for simultaneous slot milling . . . accurate register and timing being assured by series connected pilot and pressure sequence interlocks. Thus all three pieces are in proper position before cutters approach the work. The same positive interlocking prevents succeeding automatic index until cutters are clear.

Other advantages of these valves: (1) they automatically provide "cushioned" operation, and (2) their ease of adjustment saves set up time when a variety of types of work is to be accommodated.

Our application engineers will be glad to discuss adaptations of Vickers Hydraulic Controls to your products.


New BULLETIN
Bulletin 45-34 on Vickers Pressure Control Valves includes operation, typical applications and installation of unloading, sequence, overload relief and counterbalance valves.

VICKERS Incorporated

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

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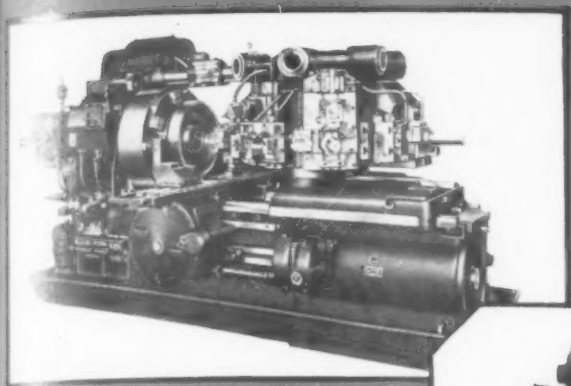
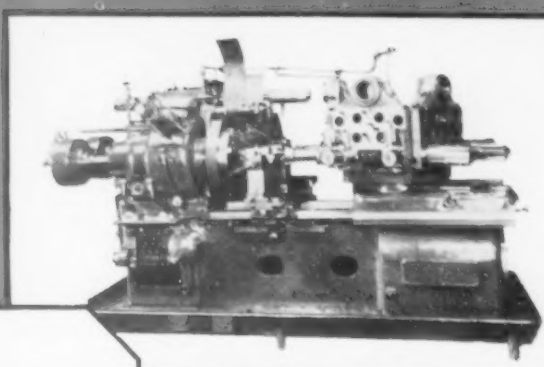
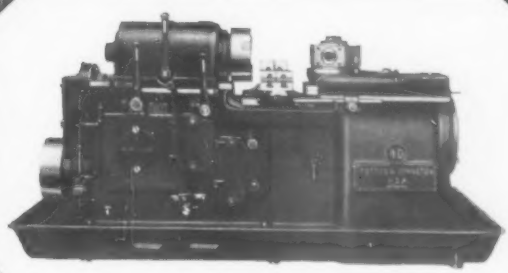
P&J



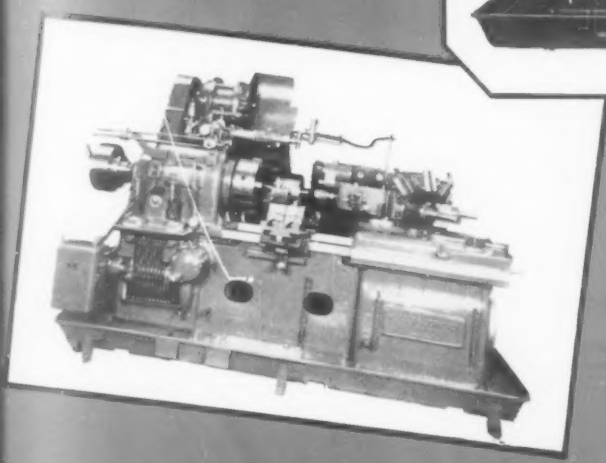
P&J 8DT and 8DXT Automatics
Bulletin 112



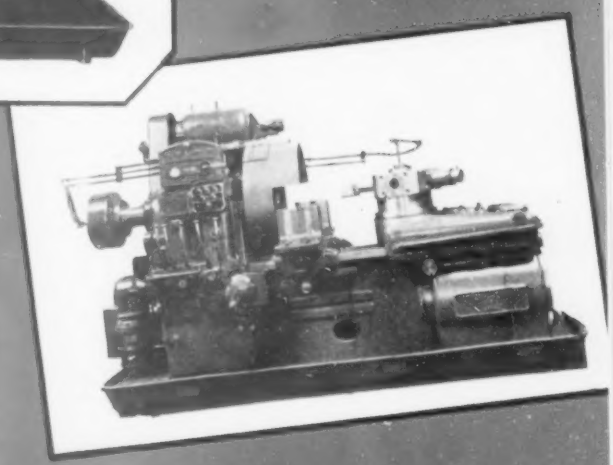
P&J 5D
Two Spindle Power-Flex Automatic
Bulletin 120



P&J 4D Automatic
Bulletin 112



P&J 5D Power-Flex Automatic
Bulletin on request



P&J 6D REL and 6D RELX
Automatics
Bulletin 118

AUTOMATIC CHUCKING *and* TURNING MACHINES

There are no practical limits – to the variety of work these machines will handle

These five models in the P&J line are designed to meet all needs of metal working shops for high production of duplicate parts at low cost for power, labor and maintenance. The capacity range covered by these machines is inclusive, parts small or large being handled with equal facility and at closely and easily held tolerances. Tooling to meet specific requirements is an inherent, advantageous feature of every machine in the P&J line.

Send for illustrated, descriptive literature.

BUY VICTORY BONDS TODAY FOR SECURITY TOMORROW

POTTER & JOHNSTON MACHINE CO.

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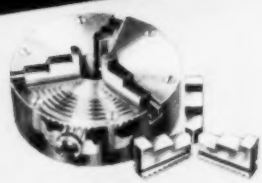
A WORLD STANDARD FOR PRECISION

No matter what your Work Holding Problem . . . consult CUSHMAN

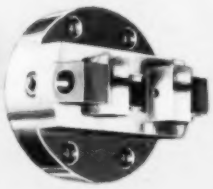
Light Duty



3 JAW
SELF-CENTERING

4 JAW
INDEPENDENT

Medium Duty

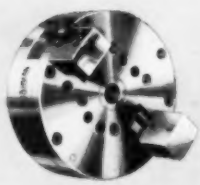


2 JAW
SELF-CENTERING

3 JAW
SELF-CENTERING

4 JAW
INDEPENDENT

Heavy Duty

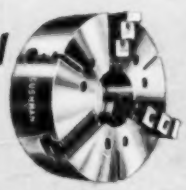


2 JAW
SELF-CENTERING

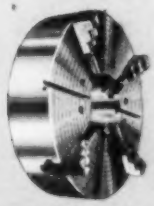
3 JAW
SELF-CENTERING

4 JAW
INDEPENDENT

Extra Heavy Duty



3 JAW
SELF-CENTERING



4 JAW
INDEPENDENT

Cushman Chucks are now being made in a wider range of types, sizes and jaw specifications for mounting on American Standard Type A-1, Cam-lock Type D-1 and Long Taper Key Drive Spindle noses, as well as for use on threaded spindles, using adapter plates. We are ready to serve you to meet post war requirements on expanded production lines. The right chuck with the right jaw equipment can help you reduce machining costs. Consult us.

THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONN.

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Chucking Engineers Since 1862

SET NEW PRODUCTION RECORDS!

with

Improved TECO CEMENTED CARBIDE

Get

- MORE PIECES BETWEEN GRINDS
- MORE GRINDS PER TOOL
- LESS DOWN TIME
- LOWER TOOL COST

Skeptical? So were dozens of today's enthusiastic users of Improved TECO Cemented Carbide—*before* they tried it. Now they are getting drastic increases in pieces per grind—reduced down time—higher daily production per machine—lower tooling costs.

Improved TECO Cemented Carbide has a harder, tougher, more uniform structure. This provides remarkable resistance to wear and breakage in very severe service.

PROVE IT YOURSELF! Tool up a machine on any carbide job, with the Improved TECO. Run under identical conditions and compare your pieces per grind, grinds per tool, total production per tool. Then check its ability to operate at higher speeds and feeds.

Have one of our tool engineers demonstrate, without obligation. If you prefer making your own run, send details of your set-up for proper recommendation. Ask for latest catalog and price list.

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TECO
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For

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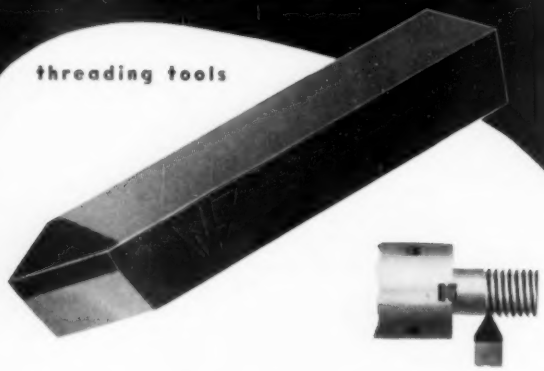
WENDT-SONIS CARBIDE TOOLS

threading tools



Now! Grooving and thread cutting operations can be done faster, more economically with Wendt-Sonis Carbide Tools. Each tool is especially designed for its job. Available from stock in a wide range of sizes and grades. Shanks scientifically hardened. Cutting angles are based on exhaustive tests made under actual production conditions. Use Wendt-Sonis Carbide Tools to increase your production — help combat rising costs. Get complete details by writing WENDT-SONIS COMPANY, Hannibal, Missouri or 580 North Prairie Avenue, Hawthorne, California.

WS

WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOT-FACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

Now . . . Safer Stamping at Lower Cost with . . .

"Nu-Grip"* STAMPS

LETTERS
FIGURES
SYMBOLS

Stamps are made of "Safety" Mecco alloy steel, on heavy duty blanks for all stamping applications.

* Patent applied for.

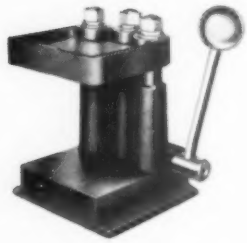
- New Design gives positive finger grip.
- Grip holes at exact point for perfect balance.
- Give workmen "feel of security" when stamps are struck by severest hammer blows.
- Available in sizes from 1/32" to 1".
- Write for data and prices.

M.E. CUNNINGHAM CO.

SAFETY STEEL STAMPS

169 E. CARSON STREET PITTSBURGH, PA.

"CONE-LOK" JIGS



The Woodworth "CONE-LOK" jig utilizes the full braking power of its perfectly mated male and female cones.

ACCURACY YOU CAN TRUST

- MECHANICAL SIMPLICITY • ADAPTABILITY
- RUGGED CONSTRUCTION • CHIP PROTECTION
- SEALED LUBRICATION • MAXIMUM SAFETY

★ CATALOG AND FULL SCALE TEMPLATES UPON REQUEST ★

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N. A. WOODWORTH CO., • SALES DIVISION

1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

That's what Counts

To Better **SERVE YOU,** Detroit Broach makes sure the story behind its OK is one of dependability. The value of an inspection OK on any tool is based on the equipment and quality standards used when making the inspection. For this very reason a Detroit Broach OK has added value.

The inspection department at Detroit Broach has complete facilities for the inspection of every broach dimension . . . facilities comprised of the finest equipment available. Every dimension—size, tooth spacing, tooth form, clearance and all the others—is checked on equipment selected specifically for the inspection of broaches to the exacting accuracy required. When Detroit Broach OK's your broaches you know they're correct... correct to the highest standards of quality—determined on the finest of modern inspection equipment.

Another reason why Detroit Broach tooling is a dependable short cut to accurate broaching production.

MEMBER BROACHING TOOL INSTITUTE

DETROIT *Broach* COMPANY

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SPEED-WET* *brings you Resin-Bond Production for dry or coolant grinding*

Resin-bond production is premium production—improved speed, stamina and finish at lower cost. Why? Because each individual abrasive grain in Speed-wet resin bonded products is twice anchored in a heat-set resin adhesive, which, once hardened, can never remelt or flow or release its grip.

When used dry, Speed-wet resin bonded abrasives are immune to cutting heats and humidity. Used wet, they are impervious to water, cutting oils or coolants.

Thus, for dry or coolant grinding, or for polishing and finishing of metals or glass or plastics, Speed-wet resin bond abrasives deliver extra performance. Specify Speed-wet Metalite for aluminum oxide grit—or Speed-wet Durite for silicon carbide. Metalite or Durite, they're both resin bonded if they are marked Speed-wet*.

*Reg. U. S. Pat. Off.

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(Division of Norton Company)

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Get SMOOTH SURFACES for Accurate Layout Work

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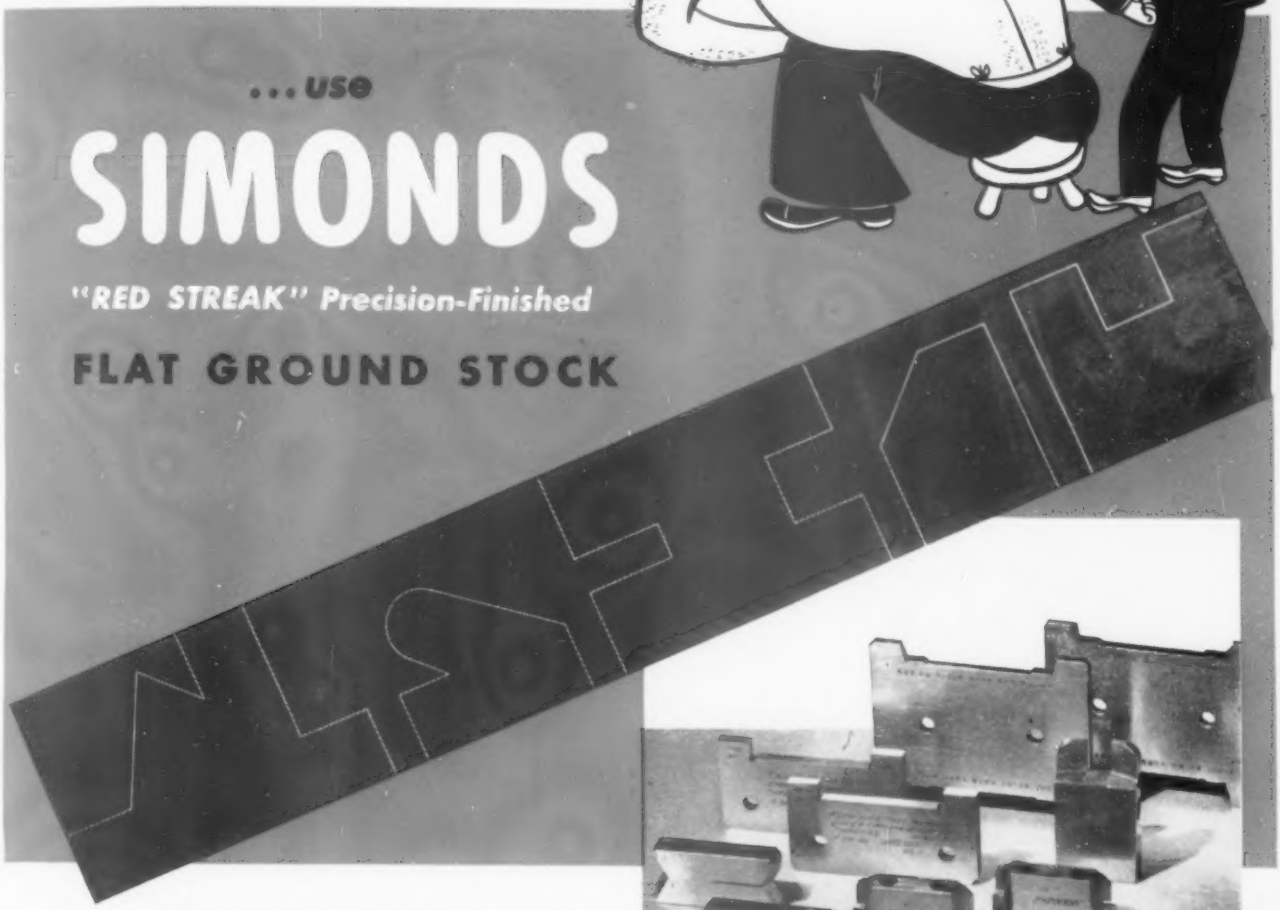
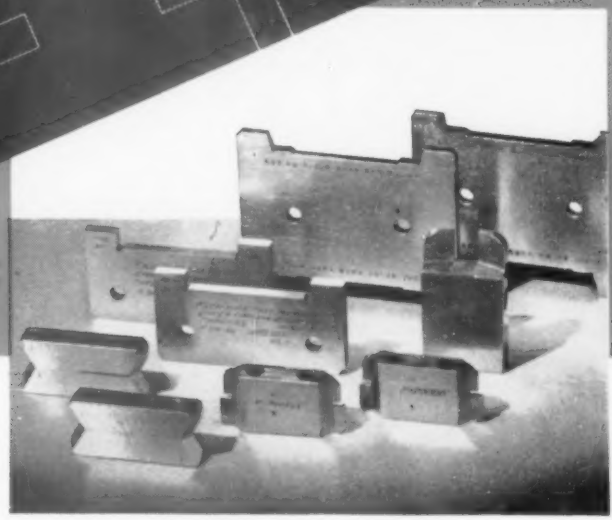
SIMONDS

"RED STREAK" Precision-Finished

FLAT GROUND STOCK





MAKE YOUR OWN GAUGES, dies, jigs, templates, stamps, shims, machine parts and small tools . . . with Simonds Oil Hardening Flat Stock, made of Simonds own alloy tool steel, uniformly annealed for easy machining and proper hardening.

SAVE TIME AND MONEY with this Flat Stock which is cut to 18" length and accurately ground to standard thicknesses and widths. *No need for the expensive machining required to grind ordinary stock to size.*

145 STOCK SIZES . . . special sizes to order. Get "Red Streak" Flat Ground Stock from your Simonds distributor, or the nearest Simonds office. Immediate delivery from stock on most sizes.

SIMONDS SAW AND STEEL CO.

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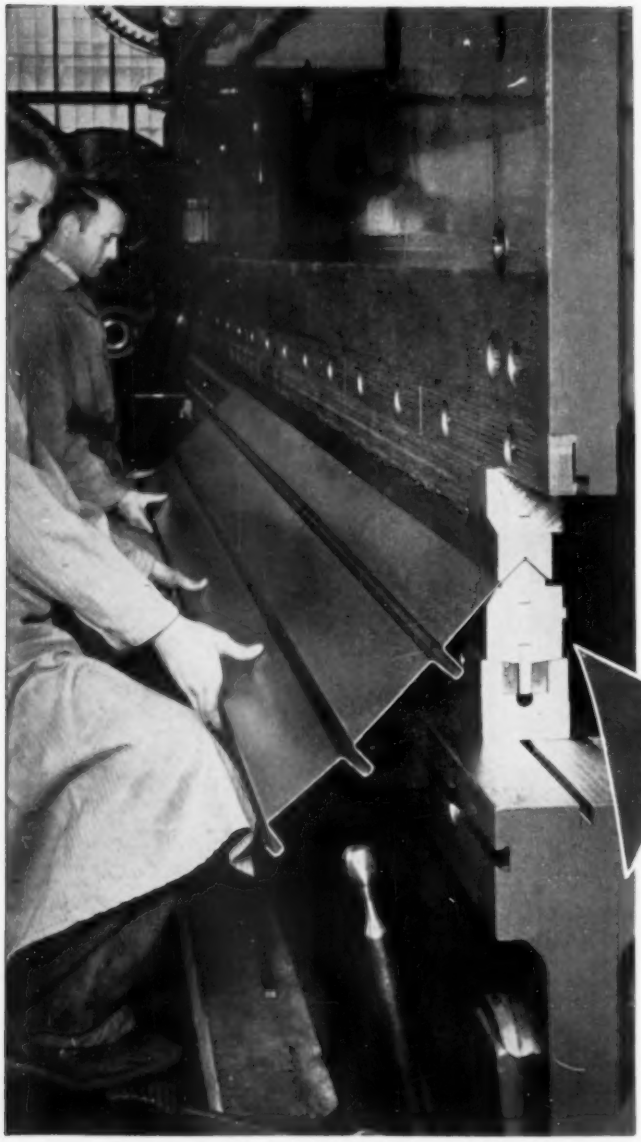
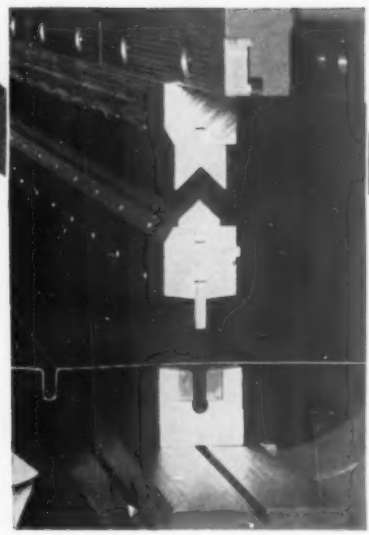
BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

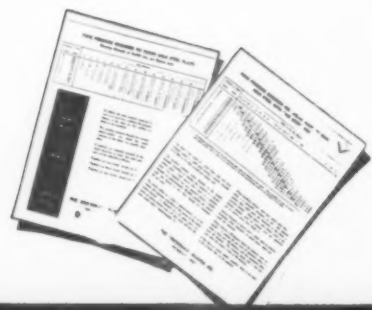


What Pressure here?



This was an unusual job. There were unusual and exacting problems in the design of the die and in the determination of the pressure. However, Cincinnati Engineering successfully designed the dies, determined pressures and recommended a Cincinnati Series 120 Press Brake for the job.

Since the pressures needed even in simple bends are governed by a number of factors, we suggest you ask the experienced Cincinnati Engineering Department for advice on your particular forming problems.



Write for Pressure Chart 2-T

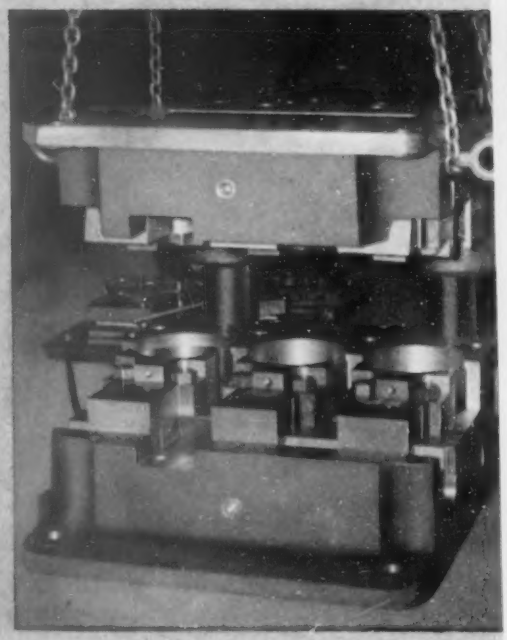
This chart may be useful to you as a general guide on the pressures required on your forming jobs.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Now Danly Special Die Sets



with any additional machining required

New equipment installed in the Danly shop permits us to do any machine work on large or complex die sets incidental to the mounting of the dies. Inserts, recesses, additional boring, keyways and other machining can be done to the customer's specifications.

Time is saved by this service as work on dies and on the die set can be done at the same time. It permits the die shop or tool room to devote their equipment and man hours to the making of dies. The problem of the handling of big sets, for which the die shop or tool room are not generally equipped to do economically, is also solved by this service.

These special die sets are then delivered ready for the mounting of the dies. Note the size and complexity of the die set shown on this page. This die set—machined at Danly—is an example of the additional machining and service which this company offers.

On your next special die set inquiry include the additional machining work that you wish done at Danly while the die set is being made. The cost of this machining will be shown as a separate item in the quotation.

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue • ***Chicago 50, Illinois***

Milwaukee 2....111 East Wisconsin
Detroit 16.....1549 Temple Avenue
Cleveland 14 1550 East 33rd Street
Dayton 2 990 East Monument
Rochester 4... 16 Commercial Street
Philadelphia 44 ..18 W. Chelten Ave.
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Ducommun Metals & Supply Company
4890 South Alameda, Los Angeles 54

DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

We know many experienced tool- and die-makers who unreservedly give BTR the green light.

Theirs is a highly-skilled craft where caution pays dividends: where safe-hardening steel is an essential. And BTR is in their shops because it meets this need.

You can quench it confidently, without fear of cracking hazards. Two reasons for this are its balanced analysis of manganese, chrome, tungsten, and vanadium—and its ability to oil-harden at relatively low temperatures.

You'll find, too, that distortion is minor: that BTR machines well and is high in both wear- and shock-resistance. Use it for dies and tools with sharp dimensional changes . . . angular corners . . . thin webs. It has many other uses, too; as a general-utility steel, it's a mighty handy grade to have on your shelves.

In the tool-steel business, "safety first" means BTR. Try it once and you'll see what we mean.

TYPICAL ANALYSIS	C	Mn	Si	Cr	W	V
	0.90	1.20	0.30	0.50	0.50	0.20

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
On the Pacific Coast
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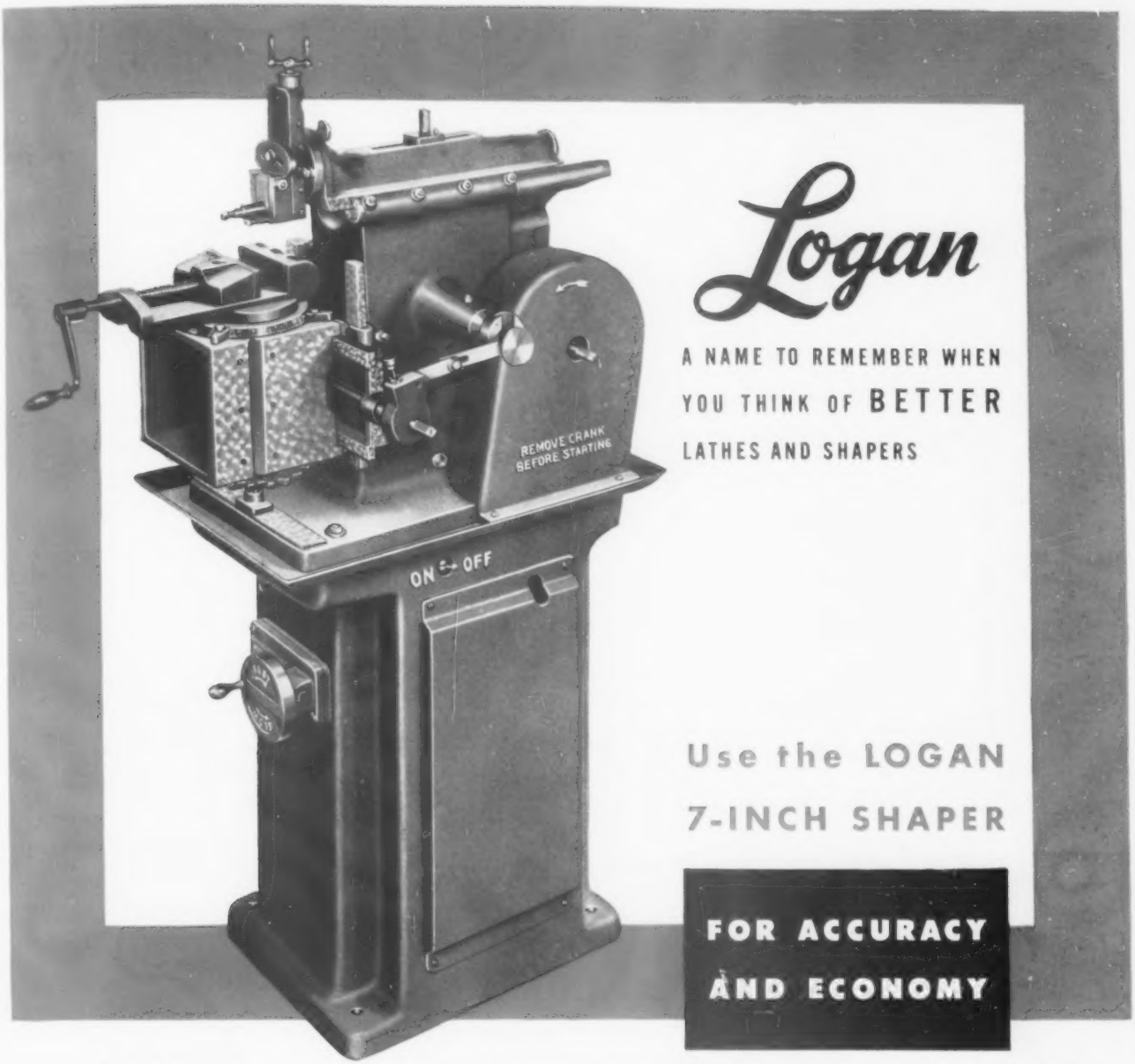
BETHLEHEM STEEL

BETHLEHEM TOOL ROOM . . . one of Bethlehem's *Big 8* Tool Steels



Logan

A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES AND SHAPERS

Use the LOGAN 7-INCH SHAPER

FOR ACCURACY AND ECONOMY

brief Logan Shaper specifications

Length of ram travel, 7⅝" . . . strokes per minute, "Anyspeed," 64 to 175 . . . length of bearings, main frame, 10" . . . length of ram, 16⅛" . . . width of ram, 5" . . . table traverse, 10½" . . . table vertical travel, 5½" . . . table length, 8" . . . table width, 8" . . . table depth, 1½" . . . saddle bearing, 6" . . . toolhead travel, 2⅜" . . . toolhead swivel, 360° . . . toolhead diameter, 4" . . . Cross feeds, 6 (.002, .004, .006, .008, .010, .012) . . . Sprocket and chain drive . . . vise 5" x 5" x 1½" . . . motor, ½ hp, 1750 rpm . . . Height over all, 51" . . . Shipping weight, shaper, stand and motor, 585 lbs.

Any shaping operation involving work within its range can be handled on a Logan Shaper at savings in set-up time and power cost, with no sacrifice in accuracy. Advanced in design, massively built throughout, with extra weight at vital points, and equipped with a positive, slip-proof roller chain drive, the Logan Shaper is smooth and accurate, even on heavy cuts. Any speed desired from 64 to 175 strokes per minute is constantly available through the "Anyspeed" Control. Operation is simple. Speeds can be changed instantly, without stopping the motor or shifting the belt. The ram is micro-set by a simple screw adjustment. There are six automatic feeds in either direction, from .002" to .012", with a half turn of the feed handle reversing the feed. The tool head may be swiveled and instantly re-set to center by means of tapered locating pins, an exclusive Logan feature. In any shop, large or small, the Logan Shaper quickly proves its all-round efficiency, wide range of feeds and speeds, and accurate, economical operation. Full particulars at your Logan dealer's, or on written request.

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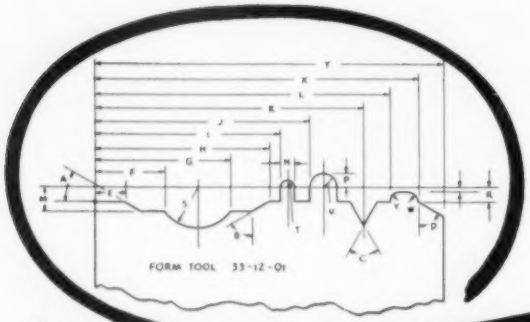
LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS



SAVE TIME AND COMPUTATIONS

..MEASURE TOOL CONTOURS DIRECTLY

WITH THE BAUSCH & LOMB

CONTOUR MEASURING PROJECTOR

IT PROJECTS a sharp, distinct, geometrically true, magnified silhouette of the object on a protractor screen where all angular measurements can be read to ±1 minute of arc (1′)—an accuracy not attainable with any other projector. Direct linear measurements, reading to ±.0001″, may be made by means of the cross slide stage with its attachments.

Dimensions, angles, and profiles of production-run parts can be compared directly with a traced outline of the projected image of the master part, or with a large scale drawing superimposed on the screen. Defects are located quickly and simply.

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BAUSCH & LOMB

OPTICAL COMPANY ROCHESTER 2, N.Y.

Columbia

TOOL STEEL

IDENTIFICATION

Every bar of Columbia carries descriptive "Name Plate" labels, also heat numbers.

This valuable identification aids selection and avoids mixups.

It pays to use Good Tool Steel

COLUMBIA TOOL STEEL COMPANY

ARTHUR T. CLARAGE, PRESIDENT

MAIN OFFICE AND WORKS

520 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

Botwinik, With Huge Rebuilding Facilities And Machine Stocks, Serves As the Machinery Partner To the Tool Engineer

The Plant That Answers 1001 Machine Tool Problems

3—Racine No. 30, capac. 10″ x 10″ Hydraulic Metal Cutting Saws (very late type).

1—Gemco 24″ Univ. Type Shaper, power rap. trav. Brand new.

1—Steptoe 14″ V-Ram, timk. bear. Shaper, forced feed lubrication. Brand new.

1—Flathers 16″ Shaper, sing. pulley drive.

1—Gould & Eberhardt 16″ Crank Shaper, bk. grd., with tilting tbl., M.D.

1—P. & W. 6″ Vert. Shaper, M.D. in base, very late type, excel. condition.

Bradford 12″ x 6′ and Bradford 14″ x 6′ Lathes. (Brand new—in orig. crates.)

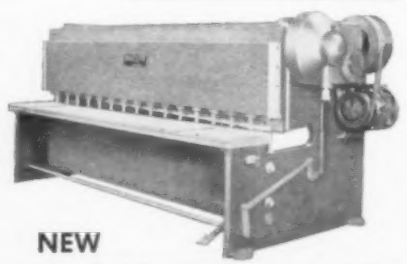
1—Amer. 24″ x 12″, 12 speed, Eng. Lathe, M.D., sw. over bed 27½″, dist. betw. cens. 84″.

2—Hendey 16″ x 6′, 8 speed, grd. hed. Eng. Lathes.

Hendey 12″ x 6′, and 14″ x 6′, yoke hed., Tool Room Lathes, with taper attmts.

L. & S. 16″ x 6′ and 20″ x 8′, 12 speed, grd., Eng. Lathes.

1—Mattison Hyd. Surf. Grinder, with mag. chuck, 18″ x 24″ x 72″, power raise and lower to vert. hed. New 1942, condition excellent.



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NEW

Rafter Steel Squaring Shears, capac. 1/4″ x 10′ and 3/16″ x 12′, 60 strokes per min., fcty. mtzd. V-Belt, range front gauge 45″, back gauge 24″, ram adj. 11/16″.

BOTWINIK BROTHERS of MASS., INC.

18 Sherman St. Worcester 1, Mass.

Now-a new die steel

FOR DIE CASTING WHITE METAL ALLOYS
AND FOR PLASTIC MOLDS

free machining

EVEN AT 275-300 BRINELL

Speed-Cut

FIRST IN QUALITY
FIRST IN PERFORMANCE

Speed-Cut machines as readily at 275-300 Brinell as ordinary die steels that have been fully annealed. Furnished in the heat treated condition, Speed-Cut saves you money by eliminating treating and polishing costs.

Also available annealed.

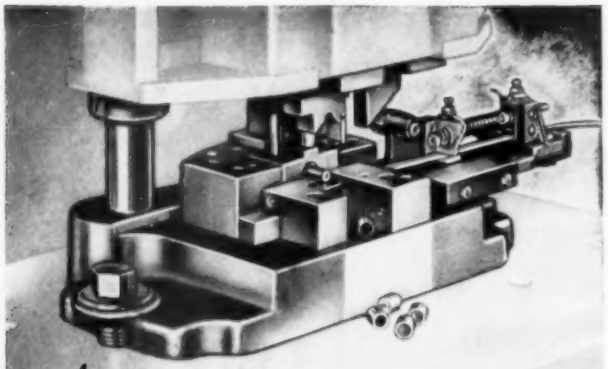
Get all the facts abo this new steel. Wr for descriptive bul tin just off press!

FIRST QUALITY TOOL STEELS

Vanadium-Alloys Steel Company

LATROBE, PA.

COLONIAL STEEL DIVISION—ANCHOR DRAWN STEEL COMPANY



for

PEACETIME PROFITS

With Dickerman Hitch Feeds for your punch presses, you'll get top production at rock-bottom cost. They are accurate, reliable and easily changed from one die to another. Send now for descriptive booklet.

DICKERMAN HITCH FEEDS

MANUFACTURED BY

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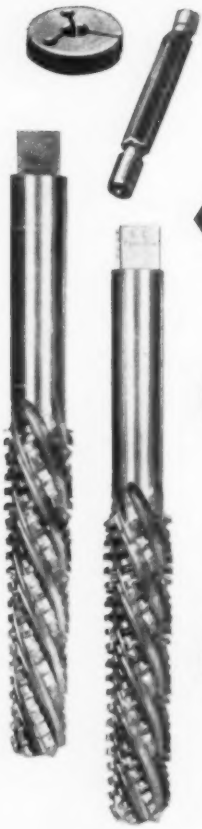
STANDARD and SPECIALIZED

GAGES

To protect your constant investment in increasingly costly labor and materials, keep up to date on Gages. *Axelson* offers standard Gages from stock and will take care of your specialized needs.



SPECIAL TOOLS

Acme Taps and other special tools are available to your order. Made under most modern and scientific conditions, Axelson Gages offer long life and minimum wear.

AXELSON GAGES

AXELSON MANUFACTURING CO.
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What TO DO FOR SPINDLE MISALIGNMENT!

How to insure against spindle misalignment caused by making hasty set-ups for tapping and reaming is now very simple. Instead of using an ordinary tool holder, use a Ziegler Floating Holder which automatically overcomes any misalignment up to 1/32" radius or 1/16" diameter.

Its patented design enables it to take any and all end-thrusts. Always floats freely. No friction or cramping even under the severest tool-driving strains. No wonder it's the favorite in leading shops throughout the nation.

It may be the solution to your production problem. You will find that it will eliminate the spoilage losses that are common with other types of holders.

W. M. Ziegler Tool Co.
1930 Twelfth St.
Detroit 16, Mich.

Ziegler ROLLER DRIVE **FLOATING HOLDER** *for* **Taps** *and* **Reamers...**

Made to Fit Any Machine

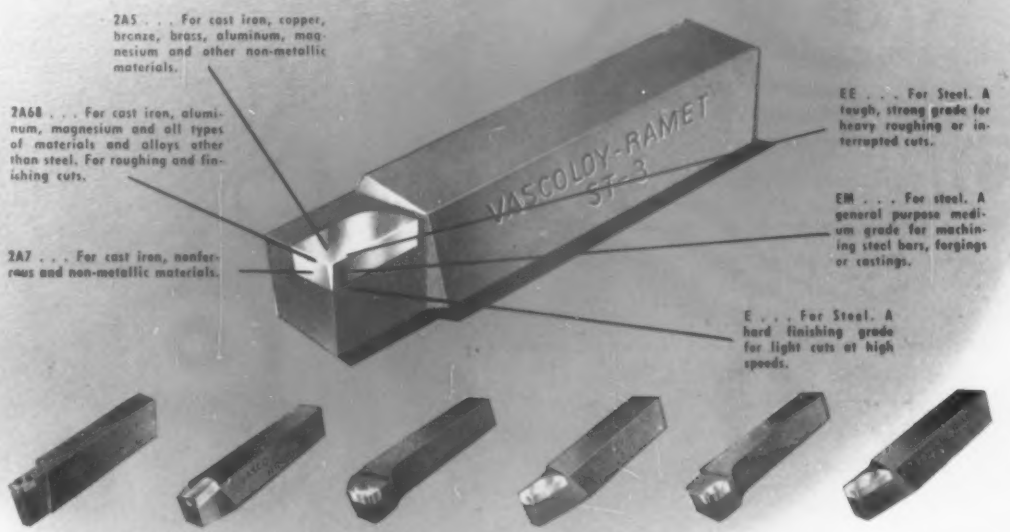
Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

Specify Carbide

VR CARBIDE

. . . and you specify the finest cemented carbide in industry. There is a V-R GRADE for every type of machining, each the most outstanding in the field. Regardless of your tool requirements, V-R can provide you with the proper tool and correct grade for maximum cutting performance.

REMEMBER TOO! . . . Vascoloy-Ramet's research facilities and field engineering service is available to help all manufacturers produce a better and less costly product.


2A5 . . . For cast iron, copper, bronze, brass, aluminum, magnesium and other non-metallic materials.
2A68 . . . For cast iron, aluminum, magnesium and all types of materials and alloys other than steel. For roughing and finishing cuts.
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EE . . . For Steel. A tough, strong grade for heavy roughing or interrupted cuts.
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VASCOLOY-RAMET
ST-3

XX Grade. For Steel. For heavy duty and shock applications at low and medium speeds.

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EH Grade. For Steel. Recommended for precision boring and light finishing cuts at high speeds where close tolerances are essential.

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Ask your nearest Vascoloy-Ramet Field Service Engineer about "CUSTOMER STANDARDS." Tools made to your design quickly, in any grade or quantity at moderate prices.

Send for the NEW V-R 400 Tool and Blank Catalog that's brimming with vital cemented carbide tool and engineering information. Practical, up-to-the-minute data on modern carbide tools that's a reference MUST for tool engineers.

MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORP. NORTH CHICAGO ILLINOIS

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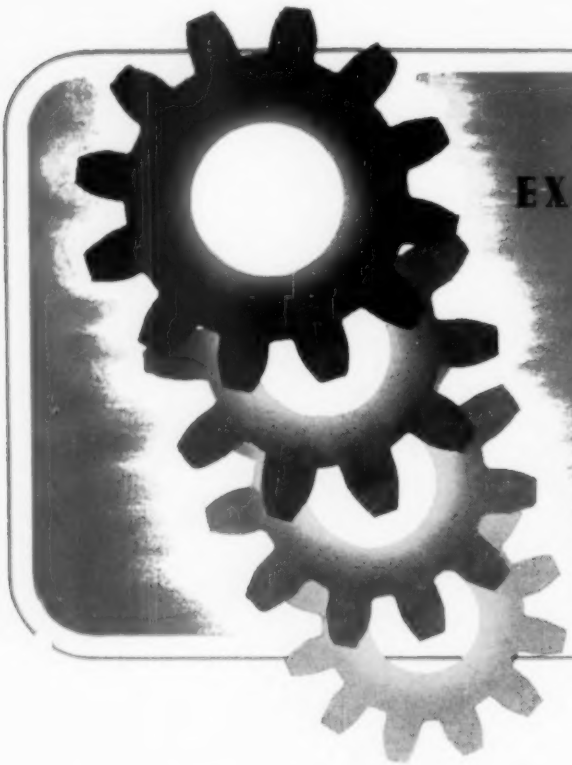

EXCELLENT CHARACTERISTICS OF SHAVED GEARS

Can be Preserved in Hardening

Gear tooth hardness need no longer be a compromise between machinability and wear resistance. Red Ring Rotary Gear Shaving as the final machining operation on the green gear, during which approximately .001″ of stock is removed from the tooth surfaces, corrects cutting errors of index, helical angle, tooth profile, eccentricity and undesirable tooth roughness.

This corrected gear may then be induction hardened to whatever surface hardness is desired and without objectionable distortion. Hardening without detrimental distortion is frequently accomplished on gears carburized after shaving by quenching in dies and sometimes by liquid carburizing and quenching without dies. No grinding of tooth profile is necessary.

On a 5.145″ P.D. gear so treated, final involute error is held to between +.00015″ and —.00015″; parallelism to .0002″; tooth spacing to .0001″ to .0002″; and accumulated error to .0008″.

WRITE FOR DESCRIPTIVE FOLDER
ON RED RING GEAR SHAVING

Specialists on SPUR AND HELICAL INVOLUTE GEAR PRACTICE

Originators of ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

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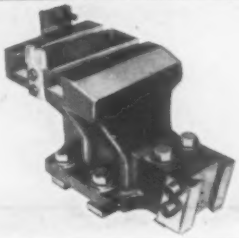
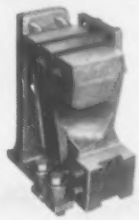
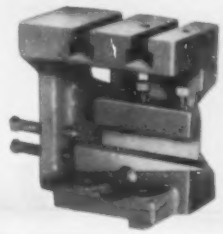


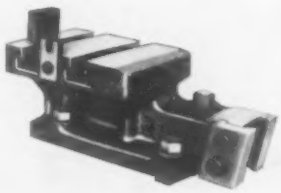
Double deck dovetail form tool holder for Acme-Gridley.



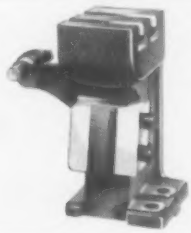
Double deck dovetail form tool holder for F or G Gridley.



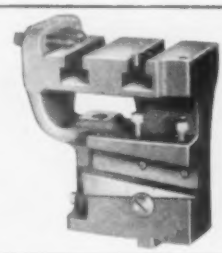
Double deck flat form tool holder for front position on F or G Gridley.



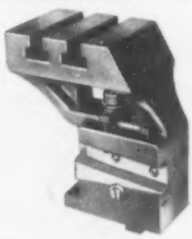
Double deck dovetail form tool holder for Acme-Gridley.



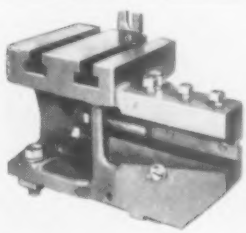
4th position double deck dovetail form tool holder with 3rd position cut-off for F or G Gridley.



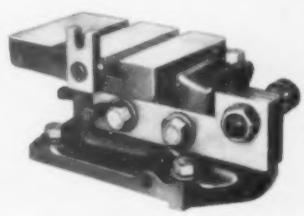
Double deck flat form and cut-off tool holder for F or G Gridley.



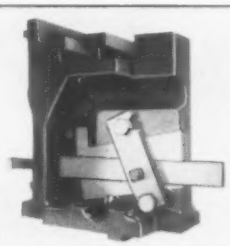
Double deck cut-off and shave tool holder for F or G Gridley.



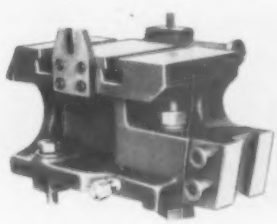
Double deck flat form tool holder for all Acme-Gridley.



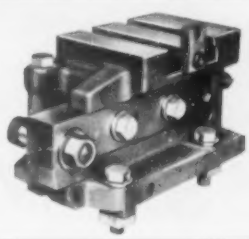
Double deck circular form tool holder for Gridley and Acme-Gridley.



Double deck flat form tool holder for front position on 1¾ to 2⅝ inch F or G Gridley.



Double deck dovetail form tool holder for Acme C Automatics.



Double deck circular form tool holder for Gridley and Acme-Gridley.

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The double deck tool holders shown here are but a few of the 400 items which comprise the SLITTER line of standard automatic screw machine tool holders. Included in our complete line are flat form, dovetail, and circular forming tool holders for C Acme, F or G Gridley, Acme-Gridley, New Britain Gridley, Greenlee, and Cone automatics. The selection is so wide and varied that you will find our standard holders capable of meeting 90% of all your requirements.

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Here's a job that called for 4 operations . . . turning, necking, threading and cutting-off. It was easily handled on a production basis on a lathe with a Colwell turret. No time lost in changing tools, for once the job was set up, changing from one tool to the next, was only a matter of seconds. Colwell turrets are inexpensive, accurate and ruggedly built. Sizes to fit most lathes. Write for catalog.

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By actual laboratory tests—this remarkable, sump-type liquid unit not only operates with three-time greater capacity—also permits a higher rate of flow, *at less pressure!*

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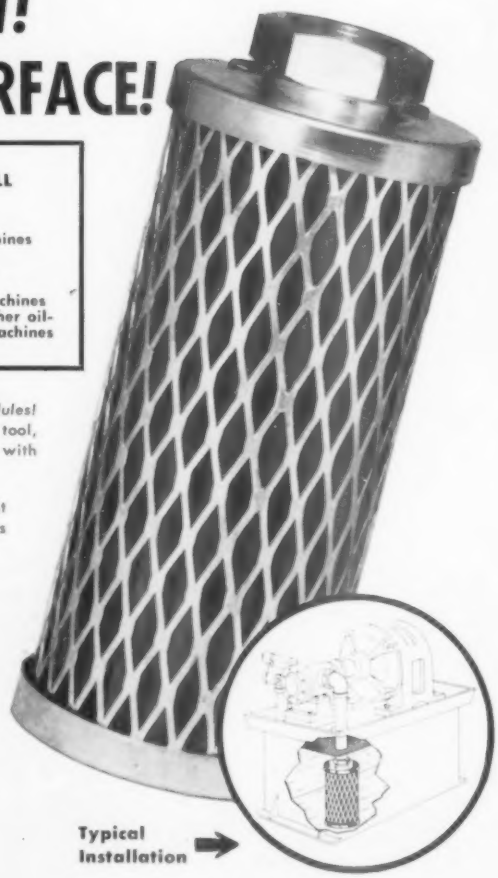

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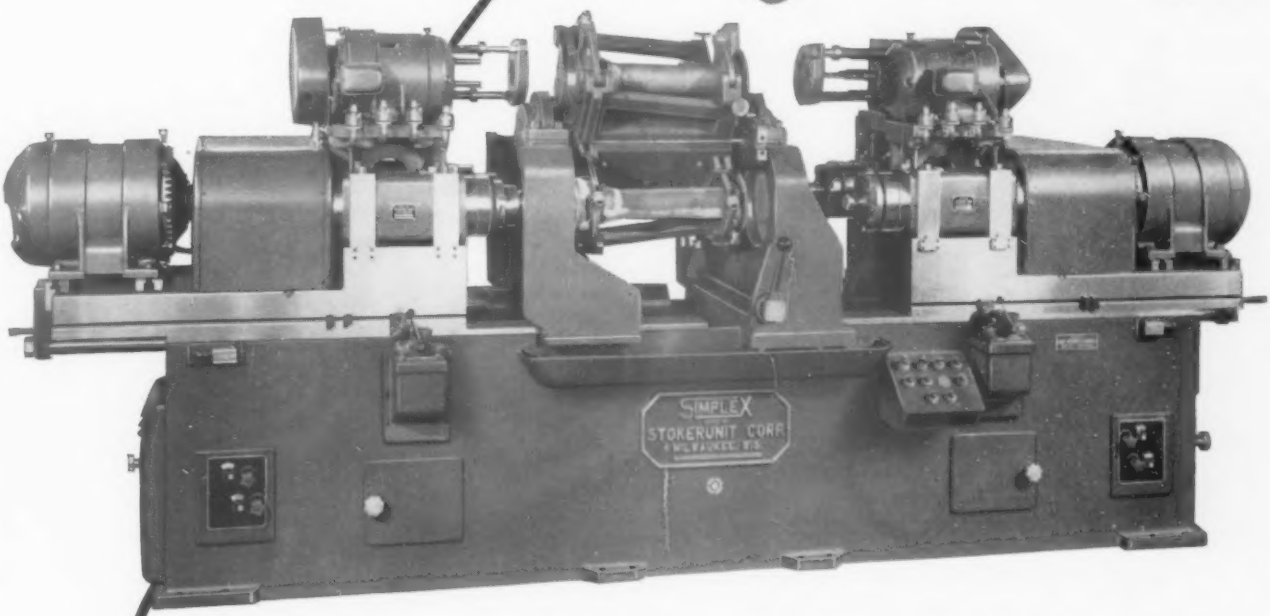
Machining tubular parts where the bores must be concentric, the faces parallel, is a difficult job unless the work can be completed in one loading. When, in addition to machining the bores and faces you can also add the drilling and tapping operations in the same setting and provide for handling a variety of jobs in the same equipment, you have a production method that meets today's needs for quality and low labor cost.



The machine pictured is a SIMPLEX 4U 2-way Precision Boring Machine with four #4 spindles mounting combination boring and facing heads and also carrying unit type drilling heads with bushing plates for the drilling operation. By changing the fixtures, drills and boring tools, the various pieces illustrated can be handled with the same machine, thus this machine becomes in effect a production department in itself.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

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Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

The Hartford 28 Machine, manufactured by the Hartford-Empire Company, is an economical producer of seamless tumblers. On this and similar machines, Ampco Metal is used for bushings, bearings, gears, glands, brackets, sprocket levers, and cam rolls.

A machine needs *guts** to make a tumbler

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Ampco Metal is the modern aluminum bronze — characterized by great strength, controlled hardness, corrosion resistance, and superior bearing qualities. Ampco Metal is available in seven grades and several modifications—can be produced by centrifugal or sand casting, extruding, or forging.

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GAGE LIFE IS *8 months* WITH
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Ask your regular supplier about NORBIDE gages or for additional information write to:

NORTON COMPANY • **Worcester 6, Mass.**

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REGISTERED TRADE-MARK

Increase production with this DOUBLE SLIDE Bore-Matic

Heald No. 42 Bore-Matic provides two-way slide motion at right angles

WHEN YOU'VE GOT a heavy production schedule to meet, here's the machine that can carry a double load. It's the Heald No. 42 Bore-Matic, incorporating two hydraulically-controlled slide movements at right angles.

Think how you can speed your work by combining boring, turning, plunge grooving and facing operations on this one machine—in a single automatic cycle. In addition, multiple stations substantially boost production; and simultaneous loading and borizing eliminate costly handling time.

The No. 42 Bore-Matic will perform both roughing and finishing operations on a wide variety of parts, such as connecting rods, pistons, pump housings and cylinder sleeves. For further information, get in touch with the Heald branch office nearest you, or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

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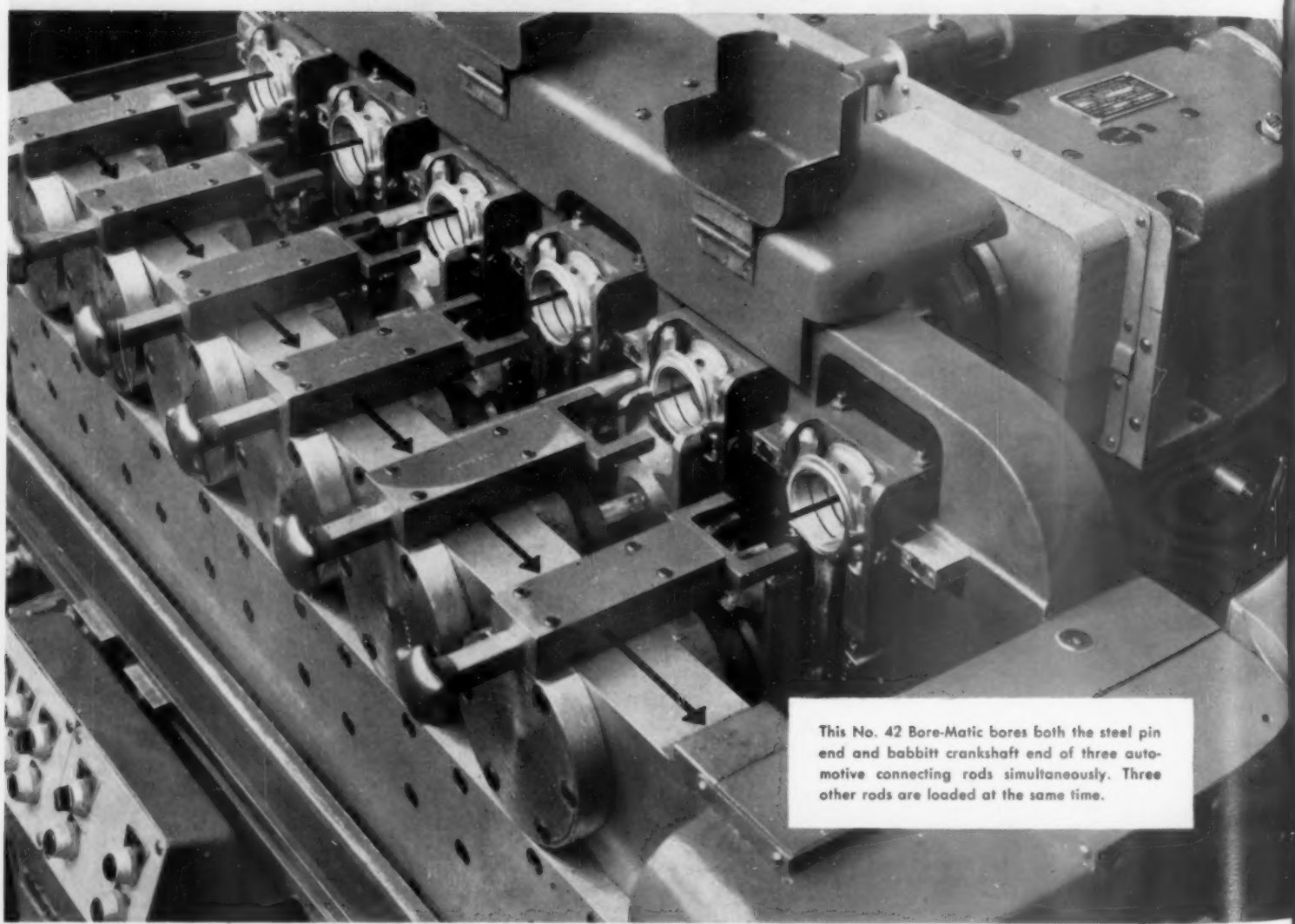

This No. 42 Bore-Matic bores both the steel pin end and babbitt crankshaft end of three automotive connecting rods simultaneously. Three other rods are loaded at the same time.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

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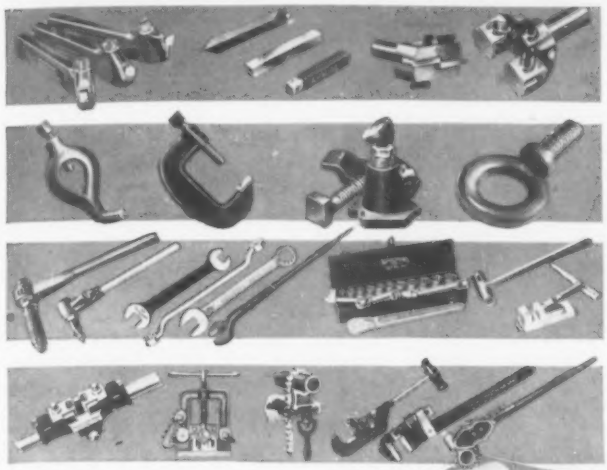
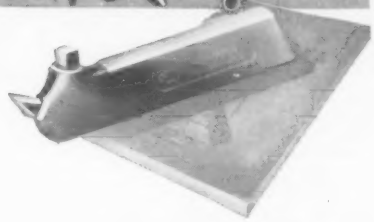


Every tool shown represents a full line of quality tools, known the world over as the finest of its type.



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2	7/16 x 3½	⅝ x 1⅜ x 7

EXTRA LONG BITS and ROUND BORING BARS AND THREADING TOOLS are available for use in the same toolholder.

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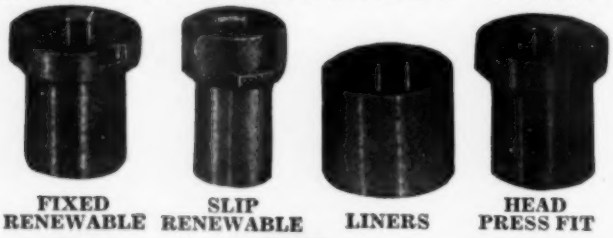

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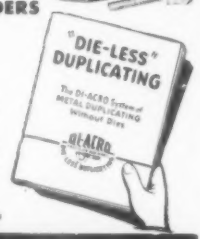

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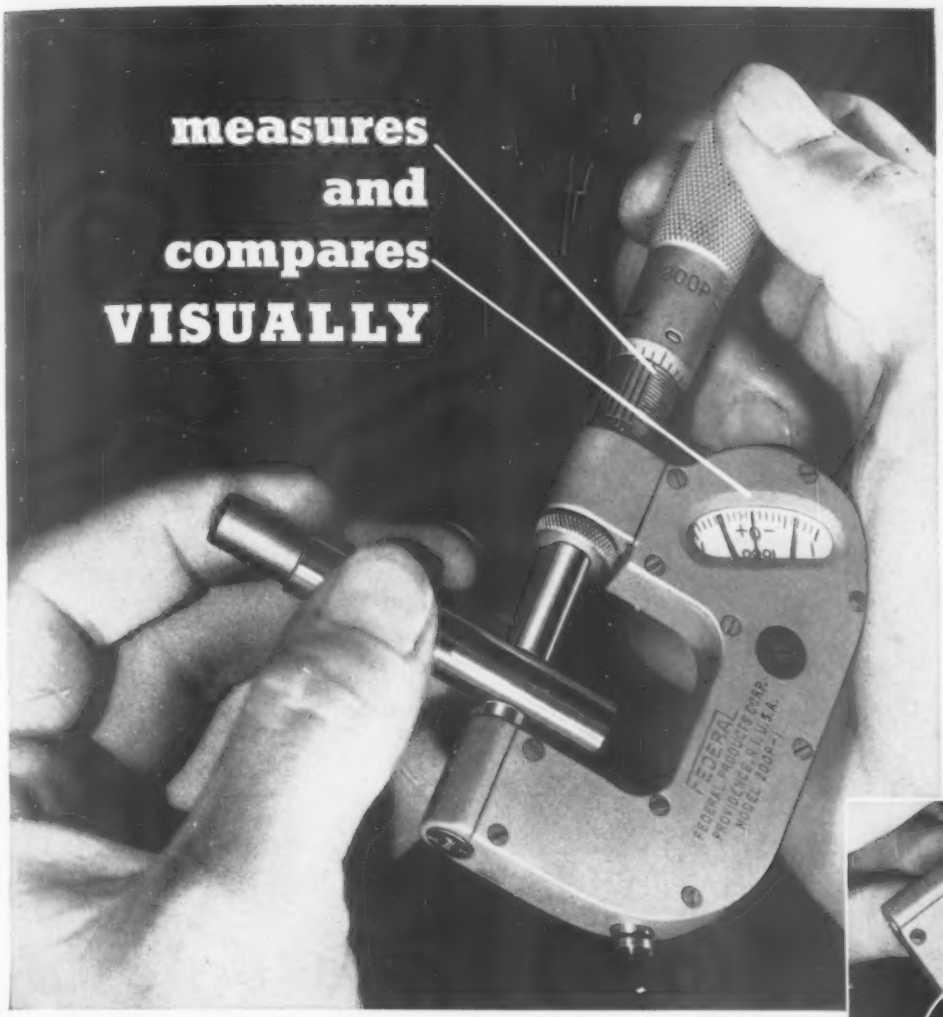

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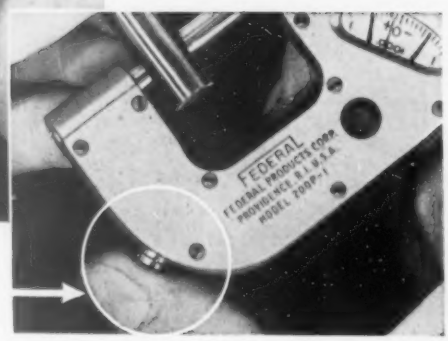

Retracting this button enables you to use the Indicating Micrometer as a snap gage on job lots

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Chromium Plated Carboloy

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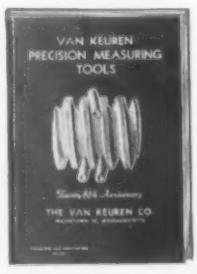

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SEE OUR CATALOG IN SWEET'S FILE

SPECIFICATIONS

Work Capacity: 24" long, 8" wide, 12" high. *Spindle:* Built-in 5 hp motor, 3450 R.P.M. ball and roller bearing. *Wheel Size:* Segment type, 6" diam. *Table Size Overall:* 59" x 10½". *Net Weight:* 3000 lbs.

ABRASIVE

ACCURACY BOOSTS PRODUCTION

REMOVES 1/32 INCH ON MOLYBDENUM STEEL WITH 10 MICROINCH FINISH

The ABRASIVE M-34 with motorized spindle using a 24 grit wheel removes 1/32" from each side of this molybdenum steel oyster dredge bar tooth. Fast and accurate, it produces 40 pieces per hour — to a 10 microinch finish. For grinding small flat dies, washers, punches, parallels, raising blocks and similar work the M-34 is ideal. The motorized spindle delivers 5 h.p. directly at the cutting point without gearing or belting. There's no warm-up period with the M-34 . . . it grinds to close tolerances immediately upon starting. The one-piece bed casting minimizes vibration and assures lifetime accuracy. Table feeds are automatic, with hydraulic shock absorber to cushion table reversal. Standard equipment includes wet grinding attachment with motorized pump, tank, etc.

Write for detailed Bulletin.

• • •

For information regarding Abrasive Machines on the Government Surplus Tool List, send us the serial number of the machine. We will endeavor to provide attachments, accessories and repair parts as desired.

ABRASIVE MACHINE TOOL CO. · EAST PROVIDENCE 14, R. I.

why SECOMET DIAMOND WHEELS return more on your investment

Only new bortz diamonds, carefully crushed and graded by the special JKS process are used in making Secomet wheels. Extra life and clean, sharp cutting action are thus provided.

Grit sizes of 400 and coarser are available in metal, resinoid or vitrified bonds to provide proper surface for all types of tools. 500 grit and finer can be supplied for special applications.

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For all the facts, write for Bulletin 45A.

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...FOR GENERAL, AS WELL AS SPECIAL HARDNESS TESTING

With the "ROCKWELL" Superficial Tester, indentations are .005" or less in depth. Readings are as dependably accurate as on the regular "ROCKWELL" Tester, where the surface is smooth. Thus it can be used where extremely shallow tests are required. And where material is sufficiently homogeneous in depth of hardness, a test on the "Superficial" is equivalent to one on the regular "ROCKWELL." This wider range of use accounts for the trend toward the "ROCKWELL" Superficial Hardness Tester.

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AN ASSOCIATE COMPANY OF AMERICAN CHAIN & CABLE COMPANY, INC.
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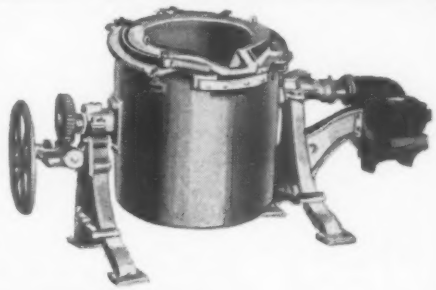
INDUSTRIAL FURNACES

OVENS • MELTING FURNACES

INDUSTRIAL HEATING FURNACES



MELTING FURNACES—for melting aluminum and magnesium. Electric, gas or oil fired.

Designs by Campbell-Hausfeld, Fisher, Stroman and others.

OVENS—for baking lacquer, enamel, synthetic resin, japanning, for low temperature metal heat treating, for drying and curing chemicals, rubber, paper, lithographing, plastics, ceramics, etc.

Made by Despatch, Gehnrich and Gehnrich, Maehler, Young Bros., W. S. Rockwell, Surface Combustion, Porbeck, General Electric, Stewart and others.

INDUSTRIAL HEATING FURNACES—

Continuous and Batch Type
Rotary Hearth
Tunnel Type
Box Type
Atmospheric Control Type

Made by these well-known manufacturers: American Gas Furnace Company, Dempsey, Despatch Furnace Company, Electric Furnace Company, Gas Machinery Company, Industrial Heating Equipment Company, Ingersoll-Rand, Lindberg, Whiting Corporation, General Electric, and many others.

These furnaces are products of the best American manufacturers. They have recently been declared surplus and are now ready to take their places on industry's production lines, to be counted again among the country's industrial assets. Every furnace is priced far lower than you have ever thought possible. Now—this very day—is the time to learn the details concerning the furnaces offered. Write, phone or visit your nearest WAA Regional Office.

Principal inventories are located at Boston, New York, Philadelphia, Richmond, Cleveland, Detroit, Chicago, St. Louis, Minneapolis, Cincinnati. However, any WAA Regional Office is prepared to give complete information and arrange for purchase. All furnaces offered subject to prior sale.

All furnaces are sold under existing priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein.

Exporters: Your business is solicited. If sales are conducted at various levels, you will be considered as a wholesaler. Any inquiries regarding export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

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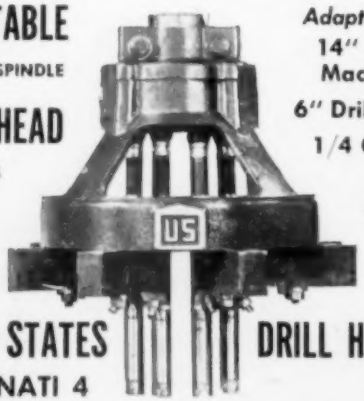
ADJUSTABLE
MULTIPLE SPINDLE
DRILL HEAD
8 SPINDLES



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6" Drilling Area
1/4 Capacity
21/32 Centers

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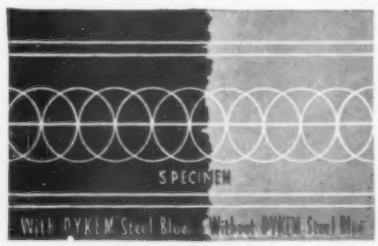
DYKEM STEEL BLUE

STOPS LOSSES
making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.
In Canada: 2466 Dundas St. West, Toronto, Ont.

If so, Insist on *CONTINENTAL* Broaches

Broaching may give you unusual opportunities for increasing production, reducing unit cost, holding closer tolerances, and improving finish . . . *all necessary to manufacture successfully in 1947!*

Continental Tool Works is a leader in the field of broaching, a process now widely used throughout the metal-working industry as one of the fastest methods to remove stock to precision limits.

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CONTINENTAL TOOL WORKS
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EX-CELL-O CORPORATION

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

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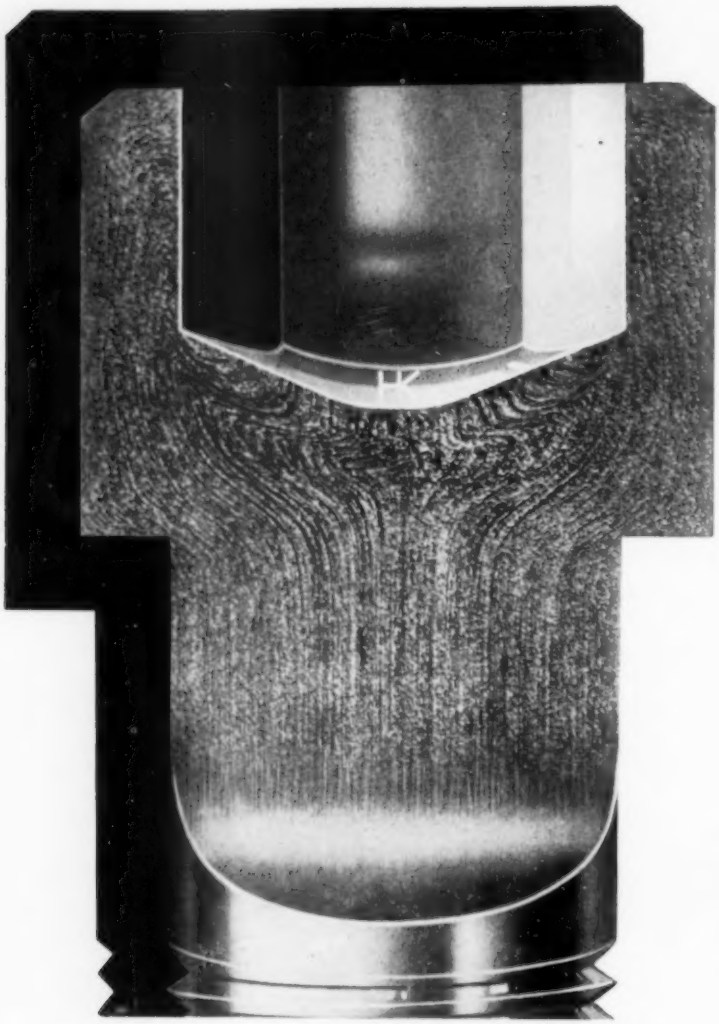

Unretouched photo — etched cutaway — Holo-Krome FIBRO FORGED Socket Head Cap Screw.

NOTICE THOSE CONTINUOUS FIBRES . . .

the results of

COMPLETELY COLD FORGING

Patented Method Owned Controlled Exclusively used by Holo-Krome

HOLO-KROME *fibro forged* SOCKET SCREWS

Continuous Fibres running from end to end! Uninterrupted, unbroken, unsevered! A stronger Socket Screw. This continuous fibrous structure is obtained by Completely Cold Forging—a Holo-Krome patented method.

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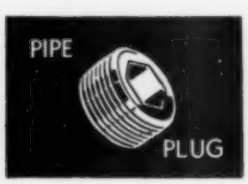
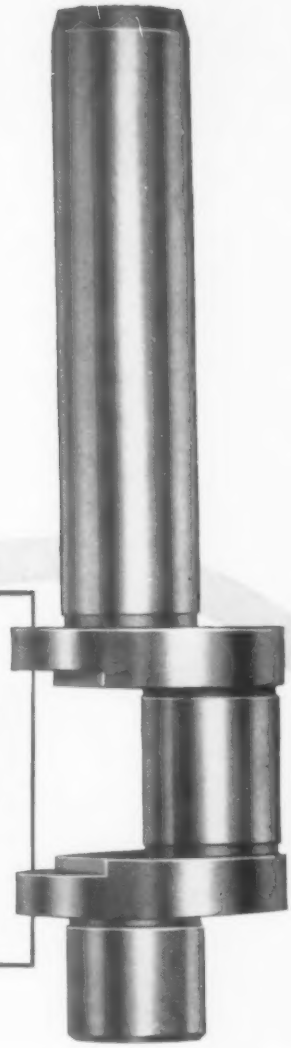
THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN. U. S. A.



2 MACHINES INSTEAD OF 4



THE crankshaft illustrated (full size) is produced by a leading manufacturer and is typical of scores of such parts being turned out throughout the nation.

The accepted procedure is to cut bar stock to length on a cut-off machine, and perform the other operations on three chucking machines . . . a relatively slow, costly procedure.

New Britain engineers proposed a complete departure: The long end is turned and the short end formed on a New Britain Six-Spindle Automatic Screw Machine. All the remaining cuts are accomplished on one New Britain Six-Spindle Automatic Chucking Machine. The same number of cuts — the same finish — with two machines instead of four. The savings in time, labor and machines are spectacular.

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Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

ENGINEERING DETAILS

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M-01053

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Twelve spindle speeds in two ranges (low: 28 to 445rpm; high: 540 to 1800 rpm) controlled by a single lever. Swing over ways 15", distance between centers variable, main drive motor 3 hp.

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your copy of Bulletin no.1

which describes the new DUAL DRIVE, may be obtained by addressing Dept. D-4.

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